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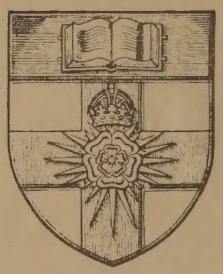

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REPORTS

FROM

COMMISSIONERS, INSPECTORS,

AND OTHERS:

THIRTY-FIVE VOLUMES.

—(8.)—

FISHERIES—*continued.*

Session

12 *March* 1894 —— 25 *August* 1894.

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EIGHTH VOLUME.

N.B.—*THE* Figures *at the* beginning of the line, *correspond with the* N° *at the foot of each* Report; *and the* Figures *at the* end of the line, *refer to the* MS. Paging *of the Volumes arranged for The House of Commons.*

FISHERY BOARD (SCOTLAND):

[c. 7428.] Twelfth Annual Report of the Fishery Board for Scotland, being for the year 1893, in three parts. p. 1

Part I. General Report.

[c. 7428–I.] Part II. Report on Salmon Fisheries. 251

[c. 7428–II.] Part III. Scientific Investigations. 355

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TWELFTH

ANNUAL REPORT

OF THE

FISHERY BOARD FOR SCOTLAND.

Being for the Year 1893.

IN THREE PARTS.

PART I.—GENERAL REPORT.
PART II.—REPORT ON SALMON FISHERIES.
PART III.—SCIENTIFIC INVESTIGATIONS.

PART I.—GENERAL REPORT.

Presented to both Houses of Parliament in pursuance of Act 45 and 46 Vict. cap. 78.

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TWELFTH ANNUAL REPORT.

TO THE RIGHT HONOURABLE

SIR GEORGE OTTO TREVELYAN, BART.,

Her Majesty's Secretary for Scotland.

FISHERY BOARD FOR SCOTLAND,
EDINBURGH, 1*st May* 1894.

SIR,

We, the Members of the Fishery Board for Scotland, have the honour to submit the Board's Twelfth Annual Report, being for the year 1893.

In conformity with the practice for some years past, the subject matter of the Report has been arranged in three parts, under the following titles:—

Part I.—General Report.
Part II.—Report on Salmon Fisheries.
Part III.—Scientific Investigations.

We have the honour to be,

Sir,

Your most obedient Servants,

P. ESSLEMONT, *Chairman.*
JOHN GUTHRIE SMITH, *Deputy-Chairman.*
GEORGE H. M. THOMS.
D. M'KECHNIE.
W. C. M'INTOSH.
W. ANDERSON SMITH.
WILLIAM BOYD.
JAMES JOHNSTON.
J. RITCHIE WELCH.

CONTENTS.

	PAGE
Introductory Statement,	v
Means of Capture,	vi
Fish Landed,	ix
Fish sold for use in a Fresh State,	xv
Fish Cured,	xvii
Herrings Branded,	xx
Cured Fish Exported,	xx
Establishment of a Hatchery at Dunbar, for the Propagation of Marine Food Fishes,	xxii
Oyster and Mussel Fishery Orders,	xxiii
Fishing Boats and Vessels constructed,	xxvi
Barrels constructed,	xxvii
Marine Superintendence,	xxvii
Casualties,	xxix
Harbours,	xxx
Telegraphic Extension to Remote Districts,	xxx
Loans to Fishermen,	xxx

APPENDICES (*see* separate Contents), ... 1

PART I.—GENERAL REPORT.

INTRODUCTORY STATEMENT.

Generally speaking the fishing season of 1893 was a fairly prosperous one. Its most remarkable features were the abundance of herrings of a uniformly fine quality, found off the East Coast, during the great summer herring fishing, and the unusually large quantity of haddocks of a very small size taken in the autumn. As a result of the productiveness of the herring fishing, the prices of cured herrings in the Continental markets fell considerably with the close of the year, and curers who had kept large stocks on hand suffered considerable loss. As far as could be gathered, the demand for Scottish cured herrings on the Continent was as good as ever, but no doubt the competition met with from Norway, Sweden, and Holland, tended to lower prices. The haddock fishing, which was so very successful in 1892, fell off considerably during 1893. The dog-fish, which were so destructive in the former year, were not observed in anything like the same numbers as in previous seasons. The West Coast loch herring fishing showed an upward tendency as compared with recent years, some lochs which had been totally unproductive for a considerable period yielding fair returns, while others contributed largely to the catch which had never previously yielded any return whatever.

A remarkable feature of the herring fishing industry was the complete change in the mode of buying and selling the fish. Formerly the system of engaging crews to fish a complement of so many crans at a certain rate, was almost universal among the curers, but of recent years the practice has gradually been becoming less common, until last season it was almost entirely superseded by the practice of selling catches by auction daily. The latter is by far a healthier system both for curers and fishermen, the former giving scope for a good deal of speculation, and placing the industry in a most unreliable and consequently unsatisfactory position. Under it terms were made with the fishermen for their fish before any idea could be gained as to how the season would turn out, and when the prices paid to the fishermen exceeded the amount

realised for the herrings when cured, the inevitable result was a crisis in the trade, numbers being unable to meet their liabilities. On the other hand, when the prices received for cured herrings were greatly in excess of their purchase price when fresh and the cost of curing, the speculation was a most profitable one, and very seductive to inexperienced curers. The system of selling the fish by auction daily, however, enables the curer to pay a price consistent with what he may expect to receive for his herrings, fresh or cured, and with the productiveness of the fishing, thus placing the transaction on a sound commercial footing.

It is gratifying to learn that the new departure made in the Report for 1892, of placing the returns in a more logical order, has been greatly appreciated. The changes made in this Report are slight, being merely in the direction of giving the returns in a more detailed form. Special attention is directed to the very interesting information now given in Appendix A. No. II., as to the fisheries prosecuted at the different creeks round the coasts.

Two additional fishery officers were appointed to assist the principal officers at Aberdeen and Wick respectively, owing to the increased duties at these stations, consequent upon the great development of the fresh fish industry in the one instance, and the transfer of the second officer previously at Wick to Lybster.

Experiments in mackerel fishing were instituted by the Board off the coast of Barra, and inquiries made through the respective British Consuls in Norway, Canada and the United States, as to the methods of fishing adopted in these places, and the demand for cured mackerel abroad. The reports received from these officials are given in Appendix P. for the information of persons interested in the development of this industry.

MEANS OF CAPTURE.

Details of the various means employed in the capture of fish round the Scottish coasts will be found in Appendix A. No. I. From an examination of this Appendix it will be seen that, compared with the figures of 1892, there were decreases of 3 per cent. in the number and $\frac{1}{5}$ per cent. in the tonnage of boats and vessels engaged in the industry; while the total value of the craft and their fishing gear showed an upward movement to the extent of 2 per cent., these variations being referable to the erasure from the Customs register of old and unseaworthy boats, and the substitution of craft of an improved and more expensive type. It will further be observed that while in the area of netting there was a falling off of $\frac{1}{2}$ per cent., the length of lines had increased by one-fourth, or eighteen million yards, a fact which shows what an increased amount of capital has been sunk by linesmen in the fishing industry, after making a reasonable allowance for bush ropes and stoppers, which were excluded from the length of lines in the

return for 1892. The return of crab and lobster creels is interesting as finding a place in the Board's Report for the first time. The decrease of 4 per cent. in the number of men is due to the augmentation in the number of beam trawlers propelled by steam and the fewer hands required, as well as to the greater attractions offered in other fields of labour where the risks to life are less and the remuneration greater.

Steam fishing boats and vessels (other than beam trawlers).

Glancing at that portion of the Appendix which deals with steam fishing boats and vessels (other than beam trawlers) it will be seen that the number returned was short of that for 1892 by 14 per cent., and that the tonnage showed a decrease of 16 per cent., while the boats, lines, and buoy ropes gave an enhanced value to the extent of 7 per cent. Turning to the length of lines, and adding thereto buoy ropes (which were included under lines in 1892), we find that they would stretch further than in the previous year by 58,000 yards—a considerable length—due to the boats going further and further afield for the harvest of the sea. A somewhat striking point is the large reduction observable in the number of fishermen and boys, amounting to 10 per cent.

Looking at this portion of the Appendix in relation to the districts it will be found that Aberdeen, Leith, and Anstruther practically claimed all the steam fishing boats and vessels (other than beam trawlers) returned, each of the first two districts being credited with 34 per cent., and the last with 26 per cent.; while of the total tonnage of the 38 boats given the Aberdeen boats absorbed 37 per cent., those hailing from Leith 39 per cent., and the 10 boats belonging to Anstruther 14 per cent. Although, however, in point of number and tonnage, there was little difference between the Aberdeen and Leith boats, the value of the boats belonging to the former district was nearly double that of the Leith boats,—the craft hailing from Aberdeen representing nearly one-half of the aggregate value of all the boats returned. A similar remark applies to length of lines and buoy ropes,—the Aberdeen boats in this respect taking the premier place with 45 per cent.

Sailing boats and vessels (other than beam trawlers).

Referring to that portion of the Appendix which deals with boats and vessels (other than beam trawlers) propelled by sails or oars we find many interesting facts regarding the methods by which the largest proportion of the fish landed on the Scottish coasts is captured. Comparing the figures of the year under review with those of 1892, we find a falling off of 3 per cent. in the number, and an increase of ½ per cent. in the tonnage of the boats; while the total value of the boats and fishing gear and implements showed an upward movement to the extent of 1 per cent., variations capable of an explanation already adverted to. Turning to the area of netting, it will be seen that there was a shortcoming of over seven million square yards, or 4 per cent., while the lines showed an increase in length exceeding five million yards. A decrease is observable in the number of fishermen and boys of over 1600, or 4 per cent.

Scanning this part of the Appendix in relation to the districts it is seen that Stornoway is credited with the largest number of

boats and vessels (excluding beam trawlers), propelled by sails or oars, the northern section of the Outer Hebrides claiming 8 per cent. of all the craft returned; while Loch Carron and Skye follows closely with 7 per cent.; Shetland coming next with 6 per cent.; and the fourth place being taken by Buckie with a fraction less. It will, however, be observed that, as regards tonnage, the Buckie boats took the premier place with 13 per cent. of the aggregate tonnage for Scotland, Anstruther ranking second with 8 per cent., while Fraserburgh came next in order with 7 per cent. Turning to nets, we find that the equipment of the Buckie boats represented in value nearly one-seventh of the total value of the nets returned for Scotland, and that 12 per cent. was claimed by Anstruther, and 8 per cent. by Fraserburgh; while the value of the lines belonging to the Fraserburgh boats was 12 per cent. of the aggregate value given, Buckie coming next with 11 per cent., and Montrose and Peterhead running each other very close for the third place with 9 per cent. In the column immediately following it is interesting to note that the value of the bush and buoy ropes and stoppers credited to Buckie represented nearly five times the value given for Findhorn, the second district in this respect, and close on one-half of the total value returned for Scotland.

Another outstanding feature is the prominence given to Barra, Orkney, and Anstruther, in the matter of crab and lobster creels, the combined value of these engines of capture belonging to the districts named amounting to 38 per cent. of the aggregate value returned. Glancing at the area of netting it will be seen that the first place was taken by Buckie with 28½ million square yards, or 17 per cent. of the total area, and that Anstruther came next with 12 per cent., and Findhorn third with 9 per cent. Turning to length of lines we find that while Buckie was best equipped in this respect, its lines extending to upwards of 8 million yards, or 4718 miles, each of the districts of Fraserburgh, Montrose and Stornoway is credited with over 7 million yards. Again, it will be observed that Buckie occupied a unique position in regard to the extent of bush and buoy ropes and stoppers, its equipment in that respect representing 42 per cent. of the aggregate return, and nearly five times that of Findhorn which occupied the second place. Glancing at the next column it will be seen that the crab and lobster creels belonging to the fishermen of Orkney, Barra and Anstruther numbered two-fifths of the grand total. The last information given in this portion of the Appendix is the number of fishermen and boys, and a reference to the column containing particulars on that subject will show that in that respect Stornoway was the district of most importance, Buckie ranking second, Anstruther third, and Shetland fourth.

Beam trawlers.

The third portion of Appendix A. No. I. deals with steam and sailing beam trawl vessels. One of the features of this return is the fact that the trawlers on the East Coast are propelled solely by steam; while wind supplies the motive power on the West Coast. It will be seen that all along the line Aberdeen occupied, in so far as Scottish vessels are concerned, the premier place in the year under review, her trawlers representing in number 53 per cent., their tonnage 52 per cent., their value and the value of their fish-

ing gear 57 per cent., and the men employed on board 54 per cent. of the aggregate returns for the East Coast. The only other district which approached Aberdeen was Leith, whose respective percentages were 36, 35, 35 and 35. Bringing into comparison the trawl vessels belonging to the various East Coast districts we find that while the average registered tonnage of an Aberdeen or Leith trawler was 36 tons, 39 tons represented that of a trawler hailing from Anstruther, 44 tons that of a Montrose boat, and 39 tons that of the only trawler placed to the credit of Fraserburgh. Turning to the next three columns it will be seen that while the average value of an Aberdeen trawler and her equipment was put down at £3,685, £3289 represented the assessed value of a Leith boat, £3308 that of a vessel hailing from Anstruther, the Montrose type of boat was valued at £2140, and the only vessel returned under Fraserburgh at £4890. Again, glancing at the men engaged, we find that while it took 9 hands to work the Fraserburgh trawler, and 8 an Aberdeen or Anstruther vessel, 7 hands were sufficient on board a Leith or Montrose boat.

It is of interest to compare the relative returns of Scottish beam trawlers and line fishing boats propelled by steam. Taking the tonnage, as coming first in order, it will be found that while the average tonnage of a trawl vessel in 1893 was 36 tons, that of a steam liner was only 24 tons. Turning to the next column a great disparity is seen in the respective values of the different types of boats, the average trawler's value being returned at £3292, while that of the steam liner was only £1368. The third item is fishing gear, and we find that the trawler's equipment was worth three of the liner's, the respective averages being £149 and £50. The last item in which a comparison can be drawn is the number of hands employed, and in this respect the two types of vessels showed a close resemblance, the trawler requiring 8 and the liner 7.

Creek return.

Appendix A. No. II. is a return showing the number and tonnage of boats belonging to each creek or fishing village in Scotland, the number of resident fishermen and boys, and the state of the fisheries during the year.

Herring boats.

Appendix A. No. III. shows the largest number of boats fishing for herrings, as well as the numbers engaged in the herring fishing industry, in each district at one time.

FISH LANDED.

Total fish landed.

The total quantity of fish landed last year (exclusive of shell-fish) amounted, in round numbers, to over 6,208,000 cwts., or 310,400 tons, an increase over the preceding year of nearly 772,000 cwts., or 38,600 tons—a most gratifying result.

The amount realised (exclusive of shell-fish, which yielded £75,350) was nearly £1,625,000, or over £29,000 above that for 1892, being at the rate of 5s. 3d. per cwt. The increase in value was therefore not commensurate with that in quantity, which is

accounted for chiefly by the glut of herrings in the markets, and the consequent low prices obtained.

Comparison with previous years.

Compared with the average for the preceding three years, the quantity was greater by nearly 630,000 cwts., but the value less by a little over £35,500. The quantity exceeded that landed in 1890 and 1891 by 343,500 cwts. and 773,800 cwts. respectively, while the value fell short of that received in 1891 by £137,600, but exceeded that obtained in 1890 by £1550.

Returns for East and West Coasts.

The quantities landed on the East Coast, Orkney and Shetland, and the West Coast respectively, were 4,452,000 cwts., 562,000 cwts. and 1,194,000 cwts., while the values were £1,224,000, £121,000 and £280,000. The proportion landed on the East Coast was 72 per cent., while 75 per cent. of the value was realised there. While the herrings landed served to make Fraserburgh the leading district, so far as quantity was concerned, the fish landed by trawlers at Aberdeen gave it an undoubted pre-eminence in the matter of value. Peterhead ran Fraserburgh closely in value, but was somewhat behind in quantity. The most important centre for the line-fishing industry on the East Coast was Aberdeen,—Montrose and Leith coming next. Fraserburgh and Peterhead were the leading districts for the herring fishing, while Aberdeen, Leith, and Montrose were by far the most favourite resorts of trawlers—Aberdeen contributing 72 per cent. of the value of the fish landed by them. Campbeltown, Inveraray, and Stornoway showed the highest values on the West Coast in the fish taken by nets—Stornoway and Ballantrae being the leading centres of the line-fishing industry.

Fish taken by different modes of fishing.

As will be seen from the tables (Appendix B. No. I), net-caught fish again preponderate largely in the returns, 4,490,000 cwts., or 72 per cent. of the whole, being taken by this mode of fishing. The most remarkable features of the returns are the very large increases in net and trawl-caught fish and the decrease in line fish as compared with 1892. The increases amounted to 821,500 cwts. and £55,000, and 45,600 cwts. and £27,500 respectively, while the decreases in line-caught fish were over 95,000 cwts. in quantity and £53,000 in value.

Prices.

The prices received for fish taken by net, line, and trawl were 3s. 7½d., 8s. 2½d., and 13s. 1d. respectively, or decreases of 5½d., 2½d., and 1½d. per cwt., as compared with 1892. The difference between the prices realised is accounted for in the case of the first by the enormous quantity of herrings caught and sold at a low rate, and in that of the line fish, as compared with the trawled, by the fact that by far the larger proportion of the more valuable flat fishes are taken by the latter mode of fishing, and that, being propelled by steam, trawlers may be able to land their fish generally in good condition, while the great majority of the line boats are propelled by sails, and are, therefore, to a great extent, dependent upon wind and weather.

Fish taken by nets.

Herrings contributed upwards of 4,424,500 cwts., or over 71 per cent. towards the total catch, and realised over £806,300 (3s. 8d. per cwt.), or nearly 50 per cent. of the total value, representing increases over 1892 of 769,400 cwts. in quantity, and of over £50,000 in value. Sprats also showed a considerable increase as compared with the preceding year, the yield

at the Inverness and Beauly Firths fishings being particularly good. The price, however, was low—1s. 6d. per cwt.—a large proportion of the catch being used for manure purposes. The quantity of sparlings taken was, as usual, small, but the prices received were most remunerative, this fish being considered quite a delicacy. The 376 cwts. landed were sold for £1580, or £4, 4s. per cwt.—the highest rate received for any kind of fish. The Firth of Tay yielded the bulk of the catch. Although the quantity of mackerel taken was nearly 600 cwts. less than in 1892, the amount received was over £600 in excess of that year's returns, the rates per cwt. being 15s. 5¼d. and 9s. 3¾d. respectively. In view of this fact and of the great demand for cured mackerel in the United States (see Appendix P.), it is to be hoped that some of the enterprising Scottish curers will embark in the industry, and thus open up a fresh field for the energies of the West Coast fishermen especially, as from the returns it will be seen that the bulk of these fish are taken on that coast—Inveraray and Ballantrae districts being the principal contributors. Of fish not separately enumerated, 3500 cwts., valued at nearly £900, were landed by means of nets. The East Coast districts contributed 3,218,000 cwts. towards the total quantity taken by nets, the West Coast 935,000, and Orkney and Shetland 337,000 cwts—the districts contributing most largely being Fraserburgh, Peterhead, Aberdeen, and Wick on the East Coast, and Campbeltown, Loch Carron and Skye, Inveraray and Loch Broom on the West Coast. An upward tendency is again exhibited in the case of Orkney and Shetland, the quantity of herrings landed being more than double that in 1892, which is extremely gratifying in view of the great fluctuations which periodically occur in these islands.

Fish taken by lines and beam trawls.

Round fish, which were captured by lines and trawl nets, contributed 23 per cent. towards the gross catch of all the kinds of fish landed, and over 39 per cent. of the value—flat fish (including skate) being accountable for 3 per cent. and nearly 9 per cent. of the quantity and value respectively, and kinds not specially enumerated making up the remaining 1·4 and 1·2 per cent. The proportions of round and flat fish, and fish not specially enumerated, taken by lines and trawls respectively were 75 and 25 per cent., the contributions towards the value of these fish being 66 and 34 per cent. While the returns of the line fishing exhibited the large decreases of 95,200 cwts. and £53,200 as compared with 1892, those of the trawlers increased by 45,600 cwts. and £27,500 respectively. The rates per cwt. were 8s. 2½d. and 13s. 1d., or 2½d., and 1½d., under 1892.

Returns of round fish.

Round fish, which comprise cod, ling, torsk, saithe, haddock, whiting, and conger eel, showed large decreases in the quantity and value landed as compared with 1892, but the decreases were confined to fish taken by lines, the trawling returns showing an increase in both quantity and value. The prices per cwt. received for those taken by lines and those taken by trawlers were 8s. 2½d. and 11s. 6d. respectively. The difference may be attributed to the fact that the fish taken by trawlers were landed almost altogether at two of the principal fish markets in Scotland—Aberdeen and Newhaven—and realised the best prices, whereas the catches of

the line fishermen were distributed over the whole coast, a large proportion being landed in Orkney and Shetland, where the most of them had to be disposed of to curers at a low figure. That it is not due to partiality on the part of the public for trawled fish is shown by a reference to the returns. In Aberdeen, for instance, the average price obtained for cod taken by line fishermen was a little over 10s. per cwt., while that got for trawled cod was 8s. 8d. per cwt. On the other hand, no cod was landed in Shetland by trawlers, but the price realised by the line fishermen there was only 4s. 4d. per cwt. The principal varieties of round fish taken by line were haddock, cod, and ling, while those landed by trawlers were represented chiefly by haddock, cod, and whiting, few conger eel or torsk being captured by the latter. Line fishermen landed most of their round fish at Shetland, Aberdeen, Stornoway, Montrose, Peterhead, and Leith, while the trawlers discharged almost the whole of their catches at Aberdeen and Leith. Included in the catches taken by lines are those of trawlers who were occasionally fitted out for this method of fishing and despatched to the Faroe Islands and Iceland, and those of some new steam-liners which are now fitted out solely for this industry, and which have been very successful during the year. The decreases in the quantity and value of cod and haddocks taken by lines may be attributed to the large numbers of small-sized fish of these varieties met with off the Scottish coasts during the year. The districts accountable for the largest decreases were those bordering on the Moray Firth, Wick being particularly prominent. The increases in the round fish taken by trawlers were made up by the returns of Aberdeen and Leith. The bulk of the cod, haddock, and whiting taken were landed in East Coast districts, while the greater portion of the ling and conger eel were landed on the West Coast, Stornoway being most prominent.

Haddock fishery.

The most remarkable feature, however, in the round fish industry within recent years has been the rapid development of the haddock fishing in the Orkney and Shetland Isles. In 1883, when statistics of the fish landed were first collected, the quantity and value of the haddocks landed in these islands were 7784 cwts. and £2410 respectively; in 1885 16,495 cwts. and £4915; in 1886, 24,637 cwts. and £6562; in 1887, 32,542 cwts. and £7794; then they fluctuated a little until 1892 when the best results ever recorded were obtained, the figures for that year being 39,203 cwts. and £11,499. Unfortunately, the record for 1893 exhibited a slight retrograde movement, a decrease of 9132 cwts. and £2857 respectively being shown, but this was more than counterbalanced by a large increase in the returns of the herring fishing in these districts, which also have exhibited most remarkable fluctuations within the past ten years. The largest falling off from 1892 on the East Coast was in Banff, Fraserburgh, Findhorn, and Wick districts. It is accounted for chiefly by the immense shoals of small-sized haddocks met with all along the East Coast during the year, large quantities of which were captured and afterwards returned to the sea.

Cod fishery.

Notwithstanding the fact that fishing vessels have within the past few years been proceeding further to sea in all directions in pursuit of cod, the returns for 1892 and 1893 showed a great

falling off in the quantities captured by lines. On the other hand, the quantity taken by the trawlers is on the increase, although this does not make up the deficiency in that taken by the liners. The decrease was almost wholly in East Coast districts and in Orkney and Shetland. The returns of the latter fell from 150,485 cwts. and £36,132 in 1891 to 95,013 cwts. and £22,762 in 1893,—a large deficiency in such a short period,—while the figures for the East Coast declined from 276,431 cwts. and £133,916 in 1891 to 223,068 cwts. and £89,775 in 1893, and this was confined entirely to line fishing. It is gratifying to note, however, that the deficiency was partly made up to the fishermen by the success of the ling fishing in 1893, the increases in which amounted to 36,496 cwts. and £8380 respectively. A large decrease is observable in the returns of whiting, most of which were landed in East Coast districts; the West Coast districts accounted for about six-sevenths of the conger eel, which exhibited an increase.

Other kinds of round fish.

The principal varieties of flat-fish taken were flounder, plaice, brill, halibut, skate, lemon sole, and turbot. Trawlers accounted for 41 per cent. of the take and liners for 59 per cent., but the former realised 62·7 per cent. of the value. The quantity landed, was 186,000 cwts., valued at £144,800, an increase of 8300 cwts., but a decrease in value of £7400. The returns indicate that while the line fishermen take fewer round fish than formerly their catches of flat fish are increasing, whereas the trawlers seem to be capturing fewer flat fish and a greater quantity of round fish. While the liners showed an increased catch and value of flat fish in 1893 as compared with 1892, the returns of trawled fish showed decreases. The remarkable features in the returns is that the increase in value of the line fish is not commensurate with the increase in the catch, and that in the case of the trawlers the decrease in value is much larger in proportion than that in the catch.

Returns of flat fish.

The increases in the fish taken by line were under halibut and lemon sole, the decreases being in turbot, flounder, plaice, and brill; while the increases in the trawling returns are shown under halibut and flounder, plaice and brill, the decreases are in turbot and lemon sole. The prices per cwt. (exclusive of skate) were 15s. 2d. for line-caught fish and 25s. 3d. for trawled fish. Inclusive of skate, the prices were 9s. 10d. and 23s. 9d. respectively, the average being 15s. 7d.—1s. 7d. under that obtained in 1892. The great falling off in the returns of lemon sole taken by trawlers was accountable chiefly for this result, the quantity and value declining considerably. Turbot brought in the most remunerative price to the trawlers, although there was a slight decrease as compared with the preceding year, the average obtained being 70s. 10d. per cwt.—the line fishermen realising only 31s. 4d. This is explained by the fact that almost the whole of the quantity taken by trawlers was landed in close proximity to the best markets, while more than two-thirds of the catch by liners was landed in West Coast districts, two of which (Stornoway and Loch Carron) are very remote from the most ready markets. The best price obtained by the line fishermen was 41s. 1d. per cwt. for lemon soles, of which, however, they landed only a small quantity. Almost the whole of the

halibut and skate was taken by lines, while one-third of the flounders, plaice, and brill was captured by this mode of fishing, the trawl taking nearly the whole of the lemon soles, over three-fourths of the turbot, and two-thirds of the flounders, plaice, and brill. The bulk of the halibut taken was landed at Aberdeen, Orkney and Shetland, and Stornoway, and mostly by steam liners. About three-fourths of the lemon soles captured was discharged at Aberdeen, where also less than four-fifths of the flounders, plaice, and brill taken by trawlers was landed. The 4200 cwts. of the latter fishes shown as taken by trawl on the West Coast were captured almost entirely by means of the small beam-trawlers working in the Clyde estuary and the Solway Firth, and realised nearly £3500. Aberdeen and Leith accounted for the greater portion of the flat fish taken off the Scottish coasts. As regards skate, Stornoway occupied first place in the matter of quantity, but was only fourth in point of value, Leith and Aberdeen again being the most remunerative markets—another instance of the advantage of close proximity to large centres of population.

Kinds not separately enumerated.

'Other kinds of white fish,' or those not separately enumerated, are made up of gurnard, cat-fish, hake, bream, and sillocks. The quantity landed was 89,400 cwts., or 13,000 less than in 1892, valued at £20,800, about £3200 under the preceding year, the decreases being accounted for almost entirely by the line-fishing returns.

District reports.

Particulars of the *locale* of the principal fishing grounds and of the average earnings of the fishermen in each district will be found in the reports of the various fishery officers on the state of the fisheries in their respective districts. (See Appendix O.)

Fish landed by Scottish fishermen in England and Ireland.

In addition to the fish landed by Scottish fishermen in Scotland, large quantities are taken and disposed of by them in various parts of the United Kingdom. It is estimated that 482 Scottish boats landed about 467,000 cwts. in England last year, for which they received nearly £70,000, while 83 boats landed 25,000 cwts. in Ireland, valued at £6200, making a total of 492,000 cwts. and £76,200—ample evidence of the perseverance with which our native fishermen pursue their arduous calling. The boats hailed from various districts, but those which contributed most largely were Anstruther, with 183 boats, netting nearly £36,000; Buckie, 126 boats and £18,560; Findhorn, 50 boats and £5400; and Eyemouth, 35 boats and £3600—the remainder being distributed among Leith, Montrose, Stonehaven, Aberdeen, Peterhead, Fraserburgh, Banff, Wick, and Campbeltown. Two boats from the last-named district, engaged in the mackerel fishing off the Irish coast, landed 1060 cwts. of fish, valued at £250.

Returns of shell-fish.

The upward tendency in the value of shell-fish, which was reported in 1892, was unfortunately not maintained in the past year, a falling off of over £5000 being exhibited as compared with the preceding year. Lobsters, crabs, and mussels made up almost the whole of this decrease. The number of crabs taken, however, increased to the extent of 188,000, so that the quality and size must have deteriorated considerably, as reported by several of the officers. The most valuable of the shell fisheries is that of

Lobsters.

lobsters, of which there were 721,300 captured, valued at £30,500.

The most productive districts were Stornoway, Orkney, Barra, and Wick—these localities contributing over one-half of the total catch. While Stornoway, Orkney, and Anstruther exhibited decreases, Barra and Wick showed increases in both takes and values —Stornoway and Orkney being accountable for £2250 of the decrease in the latter. Barra, on the other hand, went up to the extent of over £900. The average price obtained per hundred was £4, 4s. 8d., as compared with £4, 7s. 9d. in the preceding year. The lobster fishery has not been subject to any startling fluctuations, the general run of the results hovering round 700,000 in number and £30,000 in value, the highest point reached being 956,300 and £35,100 in 1885, and the lowest 576,400 and £24,450 respectively in 1889. The crab fishery, which ranks next in importance, exhibited an increase in the quantity landed, but a large decrease in the amount realised. The average price obtained per hundred was 9s. 4d., or a little over 1d. each, as against 10s. 9d. in 1892. The districts of Leith and Anstruther contributed more than half of the total take and value, which appears to indicate that the waters of the Firth of Forth and St Andrews Bay are the favourite resorts of this crustacean; and that while the West Coast fishermen capture most lobsters, the East Coast men lead the way in the matter of crabs. Crabs.

The favourable turn taken by the mussel fishery in 1892 was not maintained—decreases of 7400 cwts. and £1160 having to be recorded in 1893. The greatest decreases are observable in the districts bordering on the Moray Firth and in Leith district. The great sources of supply now seem to be the Firths of Clyde, Forth, and Tay—the quantity taken from the beds off Greenock and Port Glasgow alone last year amounting to 96,000 cwts., or two-fifths of the whole produce, the beds in the Firths of Tay and Forth being accountable for nearly the whole of the remainder. Large quantities are now being imported annually from Ireland and Holland. The average price paid for Scottish mussels in 1893 was 1s. 1d. per cwt. Cockles, whelks, and limpets contributed chiefly to the kinds not separately enumerated, of which there were 65,300 cwts. landed, valued at £12,200. While the quantity increased, the amount realised fell off. The West Coast districts are far ahead of the East Coast in this branch, owing mainly to the large returns of the cockle fishery, which is now an important industry, and employs a large number of persons. The bulk of the shrimps taken, which are also included under this head, are found in the Solway Firth, and are taken by means of small beam-trawls. Practically, the whole of the clams got in Scotland were taken in the Firth of Forth, where they were disposed of chiefly for bait purposes, the quantity and value obtained being 17,700 cwts. and £2400 respectively. Mussels. Other kinds.

FISH SOLD FOR USE IN A FRESH STATE.

The fresh-fish trade has developed very rapidly within the past few years. In 1893 the returns (exclusive of shell-fish) showed increases

over the preceding year of 329,400 cwts. and £3000, while they were 255,300 cwts. and £10,400 above 1891, the quantity and value of the fish consumed in a fresh state last year being 2,463,100 cwts. and £936,300 respectively, exclusive of shell-fish, which realised £75,300 and were all used in a fresh state,—thus making the total value over a million pounds sterling. Over a fourth of this amount was accounted for in Aberdeen district alone, Leith coming next with £126,000, and Campbeltown and Inveraray following with £101,000 between them. The beam-trawlers accounted for the bulk of the returns in the two former districts and the Loch Fyne herring fishing for the two latter, most of the herrings caught in that locality being sent to market in a lightly-salted or fresh state. Owing to the large decrease in the value of shell-fish taken, the gross value of the fish used fresh showed a net decrease of nearly £2200 from 1892. The fish which were used both in a fresh and in a cured state comprised herrings, cod, ling, saithe, torsk, and haddock. One of the few branches in which the returns of the West Coast exceed those of the East Coast is in the quantity and value of the herrings sent to market for consumption fresh. This is largely due to the difference in the quality of the herrings found on these coasts, those found on the former being very rich and not so well adapted for curing purposes as those met with during the great summer herring fishing on the East Coast. Then, the proximity of Glasgow to the famous fishing-grounds in Loch Fyne aids in developing the fresh herring trade on that part of the coast, swift-carrying steamers being engaged by the local fishermens' association to convey the fish from the boats to market direct. While fully 87 per cent. of the herrings landed on the East Coast and Orkney and Shetland were cured, only 34 per cent. of those taken on the West Coast were treated in that manner. Although the quantity of herrings used fresh was larger than that of any other kind of fish, the value was secondary to that of the haddocks consumed in that state. More than one-half of the cod taken was disposed of for use fresh, the East Coast districts bulking most largely in the return in this instance, as well as in ling, of which there were over 59,000 cwts. used fresh—31 per cent. of the catch. Over 32,400 cwts., or 39 per cent., of the catch of saithe was sent to the fresh-fish markets, the West Coast districts taking the precedence in this industry. Tusk (torsk) and mackerel were also cured in smaller quantities, while there was a large industry in the smoking of haddocks, various methods being adopted, the best known being the 'Findon,' 'Moray Firth,' and 'Eyemouth.' A great impetus would be given to the fresh-fish trade by the lowering of the railway rates on fish, which at present are, in many instances, almost prohibitive, and by the extension of railway communication and a service of fast trains.

Herrings used in a fresh state.

Cod and ling.

Saithe.

Tusk, mackerel, and haddock.

In this connection, it is interesting to note that the quantity of fresh fish imported into Scottish ports last year was 18,000 cwts., valued at £5000. The bulk of this return consisted of shell-fish, of which 14,500 cwts., valued at about £4000, were imported. Mussels contributed principally to these figures, these molluscs being brought over from Holland for use as bait by the line

Fresh fish imported into Scotland.

Mussels.

fishermen. Nearly 2400 cwts. of herrings, valued at £600, were also imported, principally from Norway, being brought over in ice and used as bait. As compared with the preceding year, the quantity of mussels imported decreased to the extent of 20,800 cwts., and the value by £2300. Herrings. Decrease in import of mussels.

FISH CURED.

(*a*) Herrings.

The quantity of fish cured (see Appendix D. No. I.) is still the most important item in the returns of the Scottish fisheries,—Scottish-cured herrings having earned a world-wide reputation, and being especially highly esteemed in European countries. The high standard attained is largely due to the requirements of the Board's regulations in the matter of the official Crown brand, and to the efficient supervision of the Board's out-door establishment. A very warm tribute to the reputation earned by these herrings abroad is given in a report, by H.M. Consul-General at New York, on the American mackerel fishery and trade. He states that:—'In the opinion of the trade who have handled 'Scotch herring, it is thought that, if the mackerel are prepared 'with the same care and thorough manner and neatness that 'Scottish herrings are put up, their (Scottish) mackerel will meet 'with a ready sale in this market.' The quantity of herrings cured last year was very large, compared with that of the preceding year, the increase amounting to 151,600 barrels, the total return being nearly 1,410,000 barrels. Of course, the great bulk of these were treated on the East Coast, the variety of herring taken there during the great summer herring fishing being better adapted for curing purposes than the larger and more rich Loch Fyne herring. Over 87 per cent. of the total catch on the East Coast was cured, the principal centre of the industry being Fraserburgh, with a cure of 387,000 barrels,—the largest quantity ever cured in any one district. Peterhead, Aberdeen, and Wick—in the order named—ranked next, the Shetland early herring fishing, although more productive than in the preceding year, competing with Wick for fourth place only. The fluctuations in the herring fishing in particular localities are most remarkable. Take, for instance, the cases of Wick, Shetland, and the Hebrides. During the past twelve years the largest quantity of herrings cured in Wick district was 155,700 barrels in 1883, while the smallest was only 53,500 in 1892. An upward tendency again showed itself in 1893, the figures for that year being 94,600. During the same period the returns of Shetland district varied from 134,200 barrels in 1882 to the very large total of 370,200 in 1885, after which a rapid downward tendency exhibited itself, the lowest point being reached in 1889 with 47,000. A slight recovery was manifested in the following year with 104,800, which was maintained in 1891, but in 1892 the lowest level ever experienced since 1882 was touched with 43,700. It is gratifying to note that the returns for last year indicated an improvement, the figures being 91,500. A remarkably

Good reputation of Scottish-cured herrings. Quantity cured. Fluctuations in particular localities.

7428

successful fishing was experienced in the Barra and Stornoway districts in 1891, 192,600 barrels being cured there that year; but, in 1892, the Barra fishing was a complete failure, while that at Stornoway fell off considerably, the total for both being only 103,200, and while the former showed a slight improvement in 1893, the latter yielded the poorest result recorded for a considerable period.

Value of fish cured in Scotland.

From Appendix E. No. IV. it will be seen that an attempt has been made to estimate the value of the fish cured in Scotland. Of course, it is understood that, while the estimate is as reliable as it is possible to make it, great difficulties are encountered in procuring the necessary information. Then, the price of herrings and other cured fish fluctuates considerably during the course of the year, while, at the close, large stocks are often retained by curers in the hope that prices may improve during the approaching spring. The value of the stocks is consequently valued at the rate current at the time when the books are closed. It is also, perhaps, necessary to explain that the value given has to cover the price paid to the fishermen and the cost of cure. After this explanation, it may be stated that the estimated total value of herrings cured was £1,085,000, or an average of 15s. 5d. per barrel.

Curers.

In consequence of the productiveness of the fishing, there was an addition to the number of curers curing in 1892, the increase being 44. Notwithstanding that Fraserburgh was the most important centre of the industry, the largest number engaged was at Wick, Stornoway following. There were increases in all the headings under 'herrings cured on shore,' there being a diversity in the manner of treating the fish, herrings cured gutted taking the lead. Herrings kippered followed, 87,500 barrels being cured in this manner, the principal centres being Peterhead, Fraserburgh, and Stornoway, in the order given. Anstruther was the leading district for the curing of herrings as bloaters or 'reds,' while the 'tinning' branch of the industry was carried on principally in Aberdeen district.

Different methods of curing.

Curing on board of vessels.

There was a decrease of 15 in the number of vessels fitted out for curing, and a decrease in the quantity of herrings cured gutted, but an increase in the returns of 'ungutted' fish. The headquarters of this industry was on the West Coast, most of the vessels being engaged in the Loch Carron and Loch Broom districts, the returns from these districts forming the bulk of the total results.

Neither the district of Greenock nor that of Ballantrae contributed to the quantity of fish cured, all the fish taken in these districts being either consumed fresh therein, or despatched to the fresh markets.

Return of herrings cured on East and West Coasts since 1810.

A return is shown, under Appendix D. No. II., of the quantity of herrings cured, gutted and ungutted, on the East and West Coasts of Scotland, respectively, since the constitution of the Board of British White Herring Fishery. This has never been previously given. It may be explained that, previous to 1889, the herrings slightly salted on the West Coast (more particularly in Lochfyne) were included in the return of herrings cured 'ungutted,' but, subsequent to that date, they have been treated in the returns as herrings sold for use fresh, hence the apparent large falling-off on that coast in recent years.

(*b*) Cod, Ling, and Hake.

Pickled cod and ling show a decrease, but fish cured dried an increase.

While the number of barrels of these fish pickled showed a falling-off of 3500 as compared with the preceding year's returns, there was an advance in the quantity cured dried of 14,100 cwts., and in the number of fish cured of 355,100. Orkney and Shetland bear the palm in this industry, the returns for these islands exceeding those for the East and West Coasts combined. As compared with the preceding year, a slight decrease was shown in the figures for the East Coast, but the Orkney and Shetland Islands, as well as the West Coast, exhibited increases. Over 1,860,000 fish were cured dried in Shetland alone, producing 56,900 cwts., while 477,100 fish were so treated in Orkney, and yielded 16,000 cwts. Stornoway, Anstruther, and Aberdeen followed in the order given in the number of fish, but Orkney had to yield to Stornoway in the matter of weight. Wick, again, took the leading position in the pickling department, Stornoway coming next.

Saithe and tusk cured dried.

In addition to cod and ling, large quantities of cured saithe and tusk are included under this heading, the total of 141,725 cwts. cured dried being made up as follows:—cod, 69,733 cwts., ling, 47,380, saithe, 21,238, and tusk, 3374. Apart from the cod, which is cured principally in Shetland, Orkney, and Aberdeen, most of the ling is cured in Shetland and Stornoway, while saithe and tusk curing is confined almost entirely to Shetland, the only other districts contributing to any extent being Orkney and Aberdeen.

Value of cod, ling, and hake cured.

An estimate is given in Appendix E. No. IV., of the total value of cod, ling, tusk, and saithe cured. This amounts to £114,800, the value of dried fish being £108,700, and of pickled £6100, which, added to the value of cured herrings, makes the total value of fish cured nearly £1,200,000. In the matter of value, Shetland again takes the lead, being followed by Stornoway, Orkney, and Anstruther.

Haddock curing.

In order to give some idea of the extent of the haddock-curing industry, an estimate has been formed of the quantity and value of these fish so treated. Of the haddocks landed, 369,360 cwts. were cured either as 'Findons,' 'Moray Firth,' or 'Eyemouth,' and realised £267,600. The principal centres of the industry were Aberdeen,—which yielded nearly one-half of the total return,—Peterhead, Buckie, and Montrose.

Cured fish imported.

The quantity of cured fish imported into Scotland last year was 101,000 cwts., valued at £83,700. These figures are almost identical with those for 1892, the only deviation being that the value is £300 less than in that year. The only kind separately enumerated was sardines, of which 2900 cwts., valued at £9200, were received.

HERRINGS BRANDED.

Number of barrels branded and amount of fees.

From Appendix E. No. I. it will be seen that the total number of barrels which received the crown brand was 441,255, an increase over 1892 of 80,130,—the amount of fees received being £7354, or £1335 in excess of the return for 1892. As had been the case for the preceding two years, no herrings were branded on the West Coast during 1893; the totals for the East Coast, and Orkney and Shetland, being 425,472 and 15,783 respectively; an increase in the former of 82,026 barrels, but a decrease in the latter of 1896 barrels. The principal contributors were Fraserburgh, Peterhead, Aberdeen, Wick, and Montrose, all of which exhibited increases as compared with the preceding year's returns. As showing the uniformly

Good quality of herrings.

good quality of the herrings landed during the great summer herring fishing on the East Coast last year, attention may be drawn to the fact that the largest increase in the different brands was brought out under the head of "Fulls." Of the total number of barrels cured gutted on the East Coast, fully 40 per cent. received the crown brand, while 1·6 per cent. additional was presented to the officers, but failed to satisfy the requirements of the Board's regulations. Over 235,000 barrels received the

Different brands.

"Full" brand. Increases were shown in each class with the exception of "Mat Full" and "Spent," in which the falling off amounted to 34,900 and 21,100 barrels respectively. Almost the whole of the herrings found worthy of the "La Full" brand were presented at Fraserburgh, Shetland coming next.

CURED FISH EXPORTED.

(*a*) Herrings.

Number of barrels of cured herrings exported to different countries.

The total number of barrels of branded and unbranded herrings exported to Ireland, the Continent, and to places out of Europe was over 1,045,000 barrels (Appendix E. No. II.). Almost the whole of them were shipped to the Continent,—the quantities sent to the Irish ports and places out of Europe amounting to only 33,400 and 24,700 barrels respectively. The total was made up of 417,900 barrels branded and 627,300 unbranded; while the proportion of the herrings cured exported was over 74 per cent.

It must be remembered, however, that a number of curers had stocks of cured herrings on hand at 31st December which would ultimately be exported.

Proportion branded.

The proportion of the herrings exported which were branded was almost 40 per cent., a most favourable result when compared with the 36·8 per cent. of the preceding year, and a proof of the growing popularity of the new branding regulations among the trade. The increase of 84,300 barrels in the total export was made up chiefly of herrings sent to the Continent,—the increases in the quantities shipped to Ireland and places out of Europe being immaterial. No branded herrings were sent to Ireland last year, but 33,400 barrels

of unbranded herrings were despatched there. Nearly 3000 barrels of branded herrings were shipped to places out of Europe, chiefly the United States, Australasia, and the West Indies. None were sent in 1892, and only 200 in 1891, so that it would seem as if new markets were being found for this class of fish.

Branded herrings sent to places out of Europe.

From Appendix E. No. III. it will be seen that by far the largest proportion of the cured herrings exported was shipped to German ports, the principal being Stettin, with 296,000 barrels, Hamburg and Konigsberg, each with about 153,000 barrels, and Danzig with 112,000. Of course, a large portion of these herrings was intended for Austrian and Russian markets, being conveyed thence overland. The exports to all the places mentioned exhibited large increases over the returns for 1892,—the total increase for Germany alone amounting to 67,800 barrels. Russia also exhibited an increase over 1892 of 9000 barrels,—the total shipments being 178,500 barrels, of which Libau and St Petersburg took by far the largest portion. Holland brought up the rear with a total of about 1400 barrels, an increase of 500 over 1892. The reason for the smallness of the export to the Dutch ports is accounted for by the fact that sending herrings there is very much the same thing as sending coals to Newcastle, the native herring fishing industry being one of the principal sources of that country's prosperity. It is difficult to draw any conclusions from the returns of the herrings exported from the various districts in Scotland, as large quantities are shipped from several ports which are not important curing stations. The export from Leith and Greenock, for instance, is made up almost entirely of herrings cured in other districts on the East and West Coasts, most of those shipped from Greenock being intended for the American markets; while those sent from Leith are ultimately disposed of in the Continental markets.

Different ports to which shipped.

Exports from different districts.

(*b*) Cod, Ling, &c.

It is to be regretted that the export of dried cod, ling, saithe, and torsk, showed the large decrease of 11,500 cwts. as compared with the figures for the preceding year. While the bulk of the total export, which amounted to 106,800 cwts., was shipped from Greenock, Leith, and Orkney and Shetland, none was cured in either of the two former districts,—those sent from Leith coming, in the first place, principally from Anstruther and Aberdeen, while those shipped from Greenock were cured at the Hebrides and other West Coast districts. While a large increase is exhibited in the total export from West Coast ports, a most serious falling off occurs in the returns for the East Coast ports,—the decrease amounting to nearly 28,700 cwts., made up almost entirely by the export to Ireland. On the other hand, Orkney and Shetland have improved, the quantity sent from these districts to Irish ports having almost doubled; while there is also an increase of nearly 10,000 cwts. in the export from West Coast districts to that country. Spain and other Roman Catholic countries on the Continent take most of the dried cod sent from

Export of cured cod, ling, &c., decreased.

Leith; while Ireland takes the bulk of the quantity despatched from Greenock and other West Coast ports.

Tonnage of shipping and seamen.

Particulars of the tonnage of shipping and number of seamen engaged in importing stave wood and hoops for barrels, and salt for curing, and in carrying herrings or cod coastwise, or exporting them abroad, will be found under Appendix F.

ESTABLISHMENT OF A HATCHERY AT DUNBAR FOR THE PROPAGATION OF MARINE FOOD FISHES.

In recent years, owing mainly to overfishing, a growing scarcity in the abundance of several of the more important and valuable comestible species of sea fishes has been manifested in most maritime countries where sea fishing has been largely prosecuted. As one means of meeting the constant drain on the fishing grounds, especially in inshore waters, sea fish hatcheries have been established in the United States, Newfoundland, Canada, and Norway; and the Board have recently completed a similar institution at Dunbar. Notwithstanding the extension of beam-trawling, the mode of fishing by which flat fishes are chiefly obtained, and the greater perfection of the machinery of capture, the numbers of the valuable food fishes captured off the Scottish coasts have diminished year by year. Certain regulative measures have been tried, which, if it cannot be said they have failed, have at least not had the results they were expected to have. The closure of certain portions of the territorial waters to beam-trawling, a procedure which began in 1886, and culminated in 1889 in the inclusion of practicallythe whole of the territorial waters in the prohibited area, has not been followed by a corresponding increase in the abundance of fish in the protected waters—a circumstance which points to a wide and fruitful field for the application of fish hatching.

The establishment at Dunbar will be fully described in Part III. of the present Report, which deals with the scientific work of the Board. It may be said here, however, that it consists of a small tidal pond in which a limited number of spawning fishes may be collected and preserved; a large concrete spawning tank in which the fishes at maturity are placed; a chamber for the automatic collection of the fish eggs, and for the filtration of the water; a hatching room in which the special hatching apparatus is fitted up; together with the necessary pumping apparatus. The whole of the expenditure, amounting to about £1600, has been met from the ordinary vote for scientific investigations.

The operations during the present season have been limited by the want of a sufficiently capacious sea-water enclosure. Nevertheless, over 25,000,000 eggs of the plaice have been hatched in the establishment, and arrangements are in progress with the view of obtaining a supply of adult turbot and soles, so as to admit of these fishes being propagated on a large scale, and the fry placed on the fishing grounds.

When large sea-water ponds or enclosures are added, it will be

possible to retain the young flat fish until they have assumed the habits of the adults, and thus greatly increase the usefulness of the establishment to the fishing industry.

OYSTER AND MUSSEL FISHERY ORDERS.

By the Sea Fisheries Act of 1868 (31 & 32 Vict. cap. 45), powers were conferred upon the Board of Trade to grant, upon the memorial of corporations or individuals, an Order for the establishment of oyster- and mussel-fisheries, to take effect when confirmed by Parliament. Under this Act, the following Orders were granted by the Board of Trade :—

Name of Fishery.	Date.	Grantee.	Locality.
Donibristle Oyster	1869	Earl of Moray	Firth of Forth
Holy Loch Oyster	1869	James Hunter, of Hafton	Firth of Clyde
Aberdour Mussel	1870	Earl of Morton	Firth of Forth
Buccleuch Mussel	1870	Duke of Buccleuch	Firth of Forth
Mid Forth Oyster	1870	John Anderson, of Edinburgh	Firth of Forth
Edinburgh Oyster	1871	Magistrates of Edinburgh	Firth of Forth
Greshernish Oyster and Mussel	1871	John Robertson	Isle of Skye

In 1885 all the powers and duties of the Board of Trade in this matter, 'so far as exerciseable in Scotland,' were transferred to the Fishery Board, which have since, after full enquiry into the merits of the applications, granted the following Orders :—

Name of Fishery.	Date.	Grantee.	Locality.
West Loch Tarbert Oyster and Mussel	1888	Hay & Co.	Cantyre
Loch Sween Oyster and Mussel	1891	Col. Malcolm and Major Campbell	Sound of Jura
Loch Creran Oyster and Mussel	1893	Mrs Ogilvie	Loch Linnhe

In addition to the above, the only other applications which have been received were for Lochs Spelve and Killisport, which were either withdrawn or not proceeded with ; and an application from Cockenzie, which has been granted, but awaits confirmation. An application recently received from Loch Ryan is under consideration.

The effect of an appropriating Order is to confer on the grantee a parliamentary title for sixty years to a definite portion of the foreshore, and he acquires a right of property in the oysters and mussels therein, subject to the condition that he shall properly cultivate the oyster- and mussel-ground, in accordance with certain restrictions and regulations designed for the protection of the public interest. Any invasion or interference with this ground, the

use of injurious or unlawful means of fishing, the dredging for ballast, the depositing of rubbish, and, generally, any act likely to be prejudicial to the beds, is forbidden by penalties, and the grantee becomes entitled to damages in a court of law.

When the preliminary enquiry was in the hands of the Board of Trade, complaint was frequently made of the great expense which an Order cost. Mr Farrar, permanent Secretary to the Board of Trade, informed a Committee of the House of Commons, in 1876, that it was their practice to charge £35 for an inspector's fee, and that the other expenses which had to be borne by the applicant amounted in one case to £47, 8s. In this case, however (Holy Loch Fishery), there was a local dispute, and the average expense might be taken at £21, 6s. 2d., or, including the inspector's fee, £56, 6s. 2d.

It was felt that, considering an applicant could expect no adequate return for the capital expended for a number of years after the Order was obtained, this preliminary expense was almost prohibitive. Mr Farrar, indeed, admitted that the Order 'was too 'expensive for such small grants as the French had been making, or 'as the Irish Commission have made.' It was to provide some remedy for this evil that the jurisdiction of the Board of Trade, so far as respects the preliminary investigation and the settlement of the terms of the Order, was transferred to this Board. The Board has been able to reduce the cost to about £10, but, nevertheless, it is a matter of regret that this valuable statute has not been taken advantage of to a much greater extent than it has been.

The Board is not disposed to look with much favour on grants being made, except on very rigid conditions, to the individual owners of adjacent property, but there is no reason why the fishermen themselves should not, under an Order, take the cultivation of oysters or mussels, or both, into their own hands, by means of a committee of their own appointment. The Act of 1868 places no restriction on the title to make the application. On the contrary, it expressly enacts (sect. 29) that 'any persons desirous of 'obtaining an Order' may come and ask it, and the Order, when pronounced, may include, 'if desirable, provisions for the constitu-'tion of a Board, or body corporate, for the purpose of such an 'Order,' and the body so constituted is empowered (sect. 41) 'to 'do all or any of the following things':—

(*a*) To carry into force and effect the prescribed restrictions and regulations.

(*b*) To levy tolls and royalties sanctioned.

(*c*) To provide for depositing and protecting oysters and mussels within the limits of the fishery, and for improving and cultivating the fishery.

In this manner the different fishing communities around the coast may start oyster- and mussel-fisheries of their own, with all the advantages of a special Act, specially adapted to the requirements of the particular locality. The one difficulty is the raising of the initial capital, but we do not anticipate that in most cases this would amount to a very large sum, and the revenue arising from the tolls and royalties would soon make the fishery self-supporting. The Act of 1882 authorises this Board to take such

measures for the improvement of the fisheries as the funds under our administration, not otherwise appropriated, may admit of, and it is difficult to imagine any more favourable purpose to which the surplus brand fees could be applied.

In former reports the Board have printed extracts from the Statistical Account of Scotland, showing that down to the beginning of this century the oysters around the Scottish coasts were astonishingly abundant. In the Firth of Forth, a smack with a crew of five hands could earn 30s. a day, although the price was so low as from 5d. to 7d. a hundred at Cockenzie and 5d. at Cramond. Besides supplying local demands, large consignments were sent from the Forth to Newcastle and Glasgow, where they were sold for 2s. per hundred. The trade between Leith and London employed twelve vessels from the middle of November to the middle of May, each vessel taking a cargo 'at a medium' of 320 barrels, and each barrel supposed to contain 1200 sizeable oysters. One merchant in Leith paid for ten years £2500 per annum for oysters. The reports from the parishes on the West Coast, in the same work, all speak of similar abundance. In Loch Ryan and Luce Bay the fishery was reported to be very productive. In Kintyre, the abundance was sufficient to admit of the oysters being sold at 6d. a hundred. Jura was said to possess 'the finest oysters that can 'be found, in great plenty,' and reports of a similar nature are printed from the seaboard parishes around the North of Scotland and in Orkney and Shetland.

All the authorities agree that, if this important industry is to be revived, there is only one way, viz., by following the course which has already been followed with success in France, Holland, and the United States, and give security of tenure. The beds must be made the actual property of some one person or some one community. No body of men can be expected to undertake oyster- and mussel-cultivation—a business which entails certain expenses at the start, and requires years of waiting for substantial results—unless they are certain that they shall enjoy the fruits of their industry. In a memorandum prepared for the Board by the late Inspector of Salmon Fisheries—Mr Young—he mentions as an example the oyster-beds in the Bay of Firth in Orkney, 'from which 'as much as £2000 has been drawn in a single year, and which are 'now extinct, owing to a raid made by a fleet of fishing boats.' In another report he mentions 'that about ten or twelve years ago, the 'whole bed of the Moray Firth, inside of Fort George, was discovered 'to be an oyster-bed producing oysters of very good quality. The 'discovery was made by some English smacks, and for several years 'they fished persistently, until the oysters were practically exhausted, 'and now (1889) they cannot be found in sufficient quantity to pay 'for dredging. Efforts were made to re-establish the fishing, but it 'was found that no person had a legal right, and no steps are now 'being taken to restore the beds, for the same reason.' This evidence could be multiplied indefinitely, and it is not surprising to find that the oyster-fisheries of Scotland are now so much reduced as to be threatened with extinction. The statistics collected by this Board, since it came into existence in 1882, exhibit the following startling results:—

Year.	Quantities Taken.	Value.
1883,	645,600	£3,406
1884,	517,600	2,174
1885,	220,200	809
1886,	295,650	1,205
1887,	213,000	665
1888,	152,700	742
1889,	311,933	1,453
1890,	350,200	1,526
1891,	351,200	1,568
1892,	315,000	1,532
1893,	315,700	1,481

There is printed in Appendix Q. a letter from Col. Malcolm, in whose favour the Loch Sween Order was granted in 1891, explaining the progress made in establishing an oyster- and mussel-fishery in Loch Sween, and which promises to be successful.

As regards mussels, it is of no less vital importance that steps should be taken for the restoration of the beds to their former productiveness. The fishing community are quite alive to the wastefulness and shortsightedness of the system which has too long prevailed, of leaving these valuable deposits to take care of themselves. To quote from the report of the Committee on Mussels:—'Nearly all the 50,000 fishermen in Scotland use mussels as their 'bait during some part of the year. Some do so during the whole 'year; the majority for that portion of the year when they are not 'engaged in the herring fishery.' The natural conditions for rapid recuperation already exist. A bed of mussels naturally lends itself to the work of revival, and the management required would be inexpensive. The Board entirely agree in the opinion expressed by Professor M'Intosh, in a published pamphlet, that 'if properly 'and wisely managed, a mussel-fishery will rapidly repay the small 'initial expense, and might indeed be made largely profitable.*

FISHING BOATS AND VESSELS CONSTRUCTED.

The total number of fishing boats and vessels (including trawlers) constructed in the various districts last year was 352, costing about £142,900 (See Appendix G. No. I.). The Clyde yards were accountable for only 13 vessels, but they contributed £52,000 towards the total value, all the fishing-craft built there being large trawlers intended for Hull and Grimsby owners. The largest number of boats was constructed in the Shetland Islands, but they were composed almost entirely of third-class boats, only costing about £8 each on an average. The return for Leith district consisted of 3 steam trawlers valued at £5000 each, and of 23 ordinary

* Report on the mussel and cockle beds in the Tees, Esk, and Humber, 1891.

fishing boats costing on an average £60 each. Three steam trawlers valued at £12,700 were built at Aberdeen, while 2 sailing trawlers were constructed in Ballantrae district. Anstruther led the way in the matter of steam liners, 7 of these valued at £14,900 being built there, while 3 came from Leith and 2 from Peterhead. The most valuable ordinary fishing-boats came from the yards in the various districts of the Moray Firth, Fraserburgh, and Peterhead.

BARRELS CONSTRUCTED.

In view of the importance of the herring-curing industry in Scotland, barrel-making is carried on most extensively at all the principal fishing stations, most of the curers having a cooperage in addition to their curing-yard. Cured herrings cannot be exported from Scottish ports except in barrels and half-barrels conform to the Board's regulations in size and manner of construction. The principal centre of the industry last year was Fraserburgh, where 296,000 barrels and 12,000 half-barrels were made, out of a total of 979,600 barrels and 100,400 half-barrels. Peterhead followed with 191,600 barrels and 4000 half-barrels. Very few were made on the West Coast,—the quantity of herrings cured and exported from West Coast districts being small. The wood chiefly used for staves was fir, the other kinds being made up of ash, elm, birch, alder, and larch; while the most popular method of hooping was partly with iron and partly with wooden hoops. A large quantity of staves is imported annually from Norway and Sweden; while the wooden hoops are got principally from France, and the iron hoops from England and at home.

Quarter-cran baskets, which are now legalised, are being used very extensively at certain of the fishing stations. Over 7200 were branded in Leith district last year, 3600 in Aberdeen, and 3350 in Wick. (Appendix G. No. II).

MARINE SUPERINTENDENCE.

Under this heading it is satisfactory to be able to state that the necessity for providing the Board with more efficient means for superintending the fisheries has at last, to some extent, been recognised. A sum of £5000 has been granted by the Treasury for the purchase, during the year 1894–5, of a steam cruiser which is to supersede the Board's old sailing cruiser 'Vigilant,' and is to take up the superintendence of the fisheries on the West Coast. A suitable vessel is still required for the East Coast, however, as H.M.S. 'Jackal,' the only vessel now at the disposal of the Board on that coast is engaged exclusively in the Moray Firth.

Two additional bye-laws were passed by the Board and confirmed by the Secretary for Scotland during 1893,—one prohibiting a novel method of trawling introduced in the inshore waters off Cockenzie, and the other permitting the use of beam-trawls in

small boats for the capture of shrimps off Creetown, in Wigtown Bay.

During the great summer herring fishing on the East Coast, the services of H.M.S. 'Jackal,' and the fishery cruiser 'Vigilant,' were supplemented by those of H.M.S. 'Watchful,' H.M.S. 'Cockchafer,' and H.M.S. 'Firm.' All these vessels carried out their duties in a satisfactory manner, the 'Vigilant' alone detaining 556 boats for the purpose of seeing if they had complied with the regulations in every respect (Appendix J.). The 'Watchful' detected two trawlers at work within the proscribed waters, and the 'Vigilant' one.

Injuries done by Trawlers, or other Fishing-Boats, to the Boats or Gear of Fishermen.

Appendix K, No. I., is a return, by districts, for last year of complaints made to officers of the Board, and investigated and reported on by them, of injuries done by trawlers or fishing-boats to the boats, nets, lines, or gear of fishermen, showing the result in each case.

From this return it will be seen that the number of complaints investigated and reported on by the Board's fishery officers and commanders of fishery cruisers was the lowest since 1888, with one exception, the figures for the past six years being 128 in 1888, 79 in 1889, 70 in 1890, 88 in 1891, 80 in 1892, and 71 in 1893. Of the 71 complaints investigated last year, 20 were made against trawlers and 14 against fishing-boats for damaging the lines of other fishing-boats. Of these 34 cases, 27 were satisfactorily settled on the basis of the officers' reports, 2 were not proceeded with further, and, in 5, recourse was had to legal proceedings. There were 10 complaints against fishing-boats for damage to nets, and 4 for the same offence against trawlers. Of the complaints of damage to nets, 12 were satisfactorily settled, chiefly through the officers' arbitration, while 2 were allowed to lapse. The remaining cases investigated and reported on, consisted of damage to boats or gear, cutting of crab- or skate-nets and stealing the fish therefrom, and collisions; and these were all settled without recourse to legal procedure.

Of the total number of cases, 46 arose from damage outside of the territorial waters, while 25 occurred inside. Of these, the Board's fishery officers dealt with 64, the commander of the 'Vigilant' cruiser 6, and the commander of H.M.S. 'Jackal' 1.

Damages amounting to upwards of £312 were awarded, a considerable proportion of which was paid either through the Board's officers or recovered by actions in the Sheriff Courts. In several cases compensation was made direct to the complainers or the offenders replaced the gear or repaired the damage they had caused.

From the above details it will be apparent that much annoyance and expense are avoided if those who have complaints to make, as to loss or damage to boats or gear, apply to the district fishery officers or to commanders of cruisers. These officials, in terms of

the Act of Parliament, inquire into the circumstances of each complaint, and furnish a report setting forth, as far as possible, the particulars thereof, and stating the amount of damage done and who is at fault. In the event of both parties being satisfied with the report, the matter may be settled accordingly; but if an arrangement is not made, the complainant may take the case into Court, and have the question decided there, the officers' report forming part of the evidence.

In several of the cases mentioned in the return, although the Board's officers awarded substantial damages, the offenders denied liability, and the claims were not persisted in. The complainers being, as a rule, poor men, were unable to undertake the risk and expense of prosecuting the defendants who, in most instances, were trawling firms. The losses were therefore submitted to, rather than risk failure in recovering damages.

Prosecutions against Trawlers for Alleged Illegal Trawling.

Appendix K. No. II. is a return, by districts, for last year of prosecutions against beam-trawl vessels for alleged infringement of the bye-laws of the Board, or the provisions of the Herring Fishery (Scotland) Act, 1889, and the Herring Fishery (Scotland) Act Amendment Act, 1890, prohibiting beam-trawling within certain waters round the coast of Scotland. This return shows that 11 cases were tried for contravention of the bye-laws or Acts referred to, and that convictions were obtained in every case, the fines imposed varying from £5 to £100. The total amount of fines was £375. The number of prosecutions last year again exhibited a decrease, compared with the number for each of the previous four years, the numbers for these years being 12, 22, 38, and 24, respectively.

CASUALTIES.

Unfortunately the returns (Appendix H.) of casualties show a most alarming increase on those for the preceding year, especially in the number of lives lost. Of the 123 fishermen who were drowned, 92 went down with their boats, 15 fell overboard and 8 were knocked overboard or killed by the sail. This was an increase over the year 1892 of 77, and over 1891 of 53, and has only been exceeded on three occasions since 1884. Most of the fatalities happened during the great gale in the month of November when a large number of boats were on their way home from the English herring fishing. Buckie contributed most largely to the return,—31 of the unfortunate men hailing from that district, while 18 belonged to Wick, 17 to Aberdeen, and 14 to Stornoway.

A large increase is also observable in the number of boats totally wrecked, the total, 97, being contributed to by 28 Campbeltown boats, 11 belonging to Loch Carron and Skye, 10 to Stornoway, 7 to Buckie, and 5 to Aberdeen. When the value is

taken into account, however, Aberdeen suffered to the extent of more than one-half of the total loss, which amounted to over £14,800. This is accounted for by the fact that 3 steam-trawlers belonging to that port foundered during the stormy weather experienced at the close of the year. Aberdeen also contributed nearly one-half of the total loss incurred from damage to fishing-craft, and almost one-fourth of the loss on fishing material lost or damaged The total loss in boats and fishing material amounted to £68,200 an increase on the preceding year of nearly £19,400. The bulk of this was represented by nets and other fishing material which were either lost or damaged, the principal sufferers being Aberdeen and Leith with £10,800 and £8,500 respectively. This is the greatest loss incurred since returns were first given in 1884, the next highest being £59,800 in 1885.

HARBOURS.

The statutory grant to the Board for the construction or improvement of fishery harbours round the coast remains at the point at which it was fixed in 1850, viz. £3000.

As has been repeatedly represented this sum is altogether inadequate to meet the requirements of the case. At present the Board have before them a large number of applications for assistance which they cannot entertain, some of the schemes being of national importance, and requiring a large grant to carry them out.

The amount expended by the Board on harbours last year (Appendix L. No. II.) was £2636, while they also paid over £330 in respect of a guarantee to the Public Works Loan Commissioners for a loan given by that Department to the Eyemouth Harbour Trustees for the completion of the works there. (Appendix L. No. III.)

A report by Messrs D. and C. Stevenson, C.E., is given under Appendix L. No. I., showing the progress made with the various harbours being constructed under their superintendence. The road to the Broadford Harbour has now been completed.

TELEGRAPHIC EXTENSION TO REMOTE DISTRICTS.

The extensions already carried out to different parts of the coast continue to be of great service to those engaged in the fisheries, and have aided materially in developing the industry, especially in remote localities.

A return of the amount paid to the Post Office by the Board last year, in respect of the guarantees given, is shown under Appendix M.

LOANS TO FISHERMEN.

The Board continue to adhere to their decision come to in the end of 1890 that no further advances to crofter fishermen should be made.

Of the total sum advanced (£30,111, 16s. 7d.), instalments (principal and interest) amounting to £25,047, 19s. 2d. have fallen due, the principal due being £21,951, 9s. 1d. and the interest £3096, 10s. 1d. Of these amounts there has been paid £16,756, 1s. 10d., consisting of £14,633, 12s. 8d. of principal and £2122, 9s. 2d. of interest. £7317, 16s. 5d. of principal and £974, 0s. 11d. of interest is in arrear, the total arrears being £8291, 17s. 4d.

Appendix N. No. I. is a return showing the number of loans carried out in each crofting fishery district, the amount paid over, and the total instalments received, including interest, and sums realised for seized boats, from the date on which the Crofters Holdings (Scotland) Act, 1886, was given effect to, till 31st December 1893, together with the number of loans and amount of instalments in arrear.

From this return it will be seen that the number of cases of arrears on 31st December last was 172, or 70 per cent. of the total loans issued. Compared with the number of cases and amount of loans in arrear at the corresponding period of 1892, a decrease is shown in number of 20 and an increase in amount of £1350, 14s. 5d.

The Board continue to use every endeavour to obtain payment of instalments and arrears, and it is gratifying to report that the successful fishing experienced by many of the fishermen at the East Coast fishing last summer has enabled them to clear off debt, and thus had the effect of reducing the number of cases of arrears. This is notably the fact in connection with the Hebrides fishermen, who fished chiefly at Peterhead and Fraserburgh. Many of these crews who had obtained large advances from the Board, remitted sums of from £15 to £37 during last autumn, which materially reduced the amount of their indebtedness, and in some instances the balances due on the loans were fully paid up. The increase in the amount of arrears over that in 1892 is accounted for chiefly by the fact that when boats are taken possession of and sold the balances of loans irrecoverable are debited to the delinquents, even although the instalments thereof have not matured in the ordinary course.

The difficulty of realising prices for surrendered or seized boats is increasing, as in nearly every case where a sale has had to be resorted to, the boat and gear have been in a very bad state of repair.

Up to 31st December last the Board had taken possession of and sold 73 mortgaged boats, 49 of which were voluntarily surrendered by the owners. After deducting the expenses of seizure and sale, and crediting the accounts of the delinquents with the proceeds, the amount deemed irrecoverable, exclusive of interest, is £4689, 8s. 4d., or an increase of £1370, 0s. 1d. since 31st December 1892. Of this amount, £3965, 16s. 3d. was, by the Public Works Loans Act, 1892 and 1893, written off as against the assets of the Local Loans Fund.

Particulars of cases where mortgaged boats have been sold will be found in Appendix N. No. II., which is a return of arrears of loans deemed to constitute bad debts, as at 31st December last, to write off the principal of which, against the Local Loans Fund,

the authority of Parliament is required by section 15 (2) of the National Debt and Local Loans Act, 1887 (50 Vict. Cap. 16). This return shows the fishery districts in which the loans referred to were made; the number of borrowers in each case; the dates when the loans were granted, the amount of these loans; the amounts repaid by the borrowers; the expenses incurred in prosecution of delinquents, and in taking possession of and selling boats; the dates when the boats were abandoned, surrendered, taken possession of, or wrecked; the dates when the boats were sold; the amounts realised by sales or recovered from the Companies with which the boats were insured; the net proceeds of sale credited to borrowers' accounts; the outstanding balances exclusive of interest, considered irrecoverable; and the ground on which the arrears of loans were deemed to constitute bad debts.

Since loans were first made in March 1888, 29, amounting to £1514, 6s., have been fully repaid, but in 6 of these cases the boats mortgaged in security thereof were totally wrecked, and the balances due were recovered from the Insurance Companies. In the remaining 23, the loans were for comparatively small sums, ranging from £14 to £160. In the £160 case the loan was paid by a surety.

APPENDICES.

APPENDICES.

APPENDIX A.

Means of Capture.

PAGE

I.—Return, for the year 1893, showing the total Number of persons engaged in the Capture of Fish off the Scottish Coasts; the total Number, Tonnage, and Value of the Boats and Vessels employed; and the total extent and value of Fishing Gear, ... 6

II.—Return showing Particulars regarding the State of the Fisheries at each Fishing Creek or Station on the Scottish Coasts during the year 1893, ... 16

III.—Return, for the year 1893, showing the largest Number of Boats, Decked and Undecked, *irrespective* of the places to which they belong, employed fishing for Herrings, as well as the largest Number of Persons engaged in that Industry, in each District in Scotland at *one* time, ... 68

APPENDIX B.

Total Quantity of Fish Landed.

Statement, by Districts, of the Total Quantity and Value of the different kinds of Fish landed in Scotland, in the year 1893, compared with 1892, ... 69

APPENDIX C.

Fish used in a Fresh State.

Statement showing the Total Quantity and Value of White and Shell Fish landed and sold for use in a Fresh State, or consumed Fresh in the Localities where taken, in the year 1893, . . 80

PAGE

APPENDIX D.

Fish Cured.

I.—Return showing the Number of Persons engaged in the Curing of Fish and the Quantities cured by them, distinguishing between those Cured on Shore and at Sea, and giving the Modes of Cure and the Number and Tonnage of Vessels fitted out for Curing at Sea, ... 84

II.—Statement showing the Number of Barrels of Herrings Cured, Gutted, and Ungutted, on the East and West Coasts of Scotland for the Eighty-three years ended 31st December 1893, . 86

APPENDIX E.

Cured Fish Branded and Exported, and Value of Same.

I.—Return showing the Number of Barrels of Cured Herrings Branded, distinguishing the different Brands, and the Amount of Brand Fees Collected, during the year 1893, ... 88

II.—Return showing the Total Quantity of Cured Fish Exported to Ireland, to the Continent, and to Places out of Europe, during the year 1893, ... 89

III.—Statement showing the Ports or Places to which the Herrings Exported to the Continent were Shipped, ... 91

IV.—Return showing the Estimated Value of Cured Herrings, Branded and Unbranded, as well as of Cured Cod, &c., during the year 1893, ... 94

APPENDIX F.

Return of the Tonnage of Shipping, and of the Number of Seamen engaged in the Trade of the Herring and Cod and Ling Fisheries in the year 1893; distinguishing those employed in Importing Stave Wood and Hoops; in Importing Salt; in Carrying Herrings or Cod Fish Coastwise, and in Exporting them abroad; and separating British from Foreign Tonnage and Men, . . 96

APPENDIX G.

I.—Return, for the year 1893, showing the Number and Value of Fishing Boats and Trawlers constructed within the boundaries of each District, distinguishing Steam and Sailing Vessels; into First, Second, and Third Class, ... 98

II.—Return, for the year 1893, of the Number of Barrels and the Number of Half-Barrels constructed within the boundaries of each District, showing the different kinds of Wood used and the methods of Hooping adopted, with remarks as to the Number of Barrels and Half-Barrels (if any) used outside the Districts in which they were made, or outside Scotland, and of the Number of Quarter Cran Baskets Branded, ... 100

PAGE

APPENDIX H.

Return of the Number of Lives Lost in connection with the Fisheries, and the manner in which the Casualties happened; the Number of Boats totally wrecked, and Value thereof; the Number of Boats damaged, and Amount of Damage; and the Loss on Nets and other Fishing Material lost or damaged, in the year 1893, ... 102

APPENDIX J.

Registration of Fishing Boats.

Abstract Return of Fishing Boat Proceedings in the year 1893, under Sea Fisheries Acts of 1868 and 1883, and Sea Fisheries (Scotland) Amendment Act of 1885, ... 103

APPENDIX K.

I.—Return, by Districts, of Complaints made to Officers of the Fishery Board, and Investigated and Reported on by them, of Injuries done by Beam Trawl Vessels or other Fishing Boats to the Boats, Nets, Lines, or Gear of Fishermen, in the year 1893, and showing the Result in each case, ... 104

II.—Return, by Districts, of Prosecutions, against Beam Trawl Vessels in the year 1893, for Alleged Infringement of the Bye-Laws of the Fishery Board, or the Provisions of the Herring Fishery (Scotland) Act, 1889, Prohibiting Beam Trawling within certain Waters round the Coasts of Scotland, showing the Result in each case, ... 121

APPENDIX L.

Piers and Harbours.

I.—Report by the Engineers on the state of the Harbour Works in progress under their supervision during the year 1893, . . 124

II.—Account of Receipts and Payments by the Fishery Board for Scotland, for Building, Extending, and Repairing Piers or Harbours in Scotland, in the year 1893, ... 126

III.—Statement showing the position of the Funds, at 31st December 1893, of Eyemouth Harbour Loan Guarantee, ... 127

APPENDIX M.

Telegraphic Extension.

Account of Receipts and Payments by the Fishery Board for Scotland for Telegraphic Extension to Remote Fishery Districts in Scotland in the year 1893, ... 128

PAGE

APPENDIX N.

LOANS TO FISHERMEN.

I.—Statement showing the Number of Loans carried out in each Crofting Fishery District, the amount paid over, and the Total Instalments Received (inclusive of interest and sums received for seized boats) from the date when the Crofters Holdings Act, 1886, came into operation, to 31st December 1893, together with the Number of Loans and amount of Instalments in Arrear, . . 129

II.—Return of Arrears of Loans granted on security of Boats mortaged to the Board deemed to constitute Bad Debts, as at 31st December 1893, ... 130

APPENDIX O.

Reports from the different Fishery Districts, ... 132

APPENDIX P.

Development of a Scottish Mackerel Fishery, ... 203

APPENDIX Q.

Report by Col. Malcolm of Poltalloch on efforts made to establish an oyster fishery in Loch Sween, ... 21

APPENDIX A.—

MEANS OF CAPTURE.—RETURN, for the year 1893, showing the Total Number Tonnage, and Value of the Boats and Vessels em-

No	DISTRICTS.	FISHING BOATS AND VESSELS								
		Propelled by Steam.								
		Number.	Tonnage.	Value of Boats and Fishing Gear.						
				Boats.	Lines.				Buoy Ropes.	Grand Total.
					Great.	Small.	Hand.	Total.		
	EAST COAST.			£	£	£	£	£	£	£
1	Eyemouth,	..	..	..	..	..	..	..	..	..
2	Leith,	13	360	13,000	784	..	8	792	10	13,802
3	Anstruther,	10	126	11,360	340	..	5	345	34	11,739
4	Montrose,	..	..	..	..	..	..	..	..	..
5	Stonehaven,	..	..	..	..	..	..	..	..	..
6	Aberdeen,	13	335	24,330	644	..	..	644	15	24,989
7	Peterhead,	1	71	3,000	40	..	..	40	..	3,040
8	Fraserburgh,	..	..	..	..	..	..	..	..	..
9	Banff,	..	..	..	..	..	..	..	..	..
10	Buckie,	..	..	..	..	..	..	..	..	..
11	Findhorn,	..	..	..	..	..	..	..	..	..
12	Cromarty,	..	..	..	..	..	..	..	..	..
13	Helmsdale,	..	..	..	..	..	..	..	..	..
14	Lybster,	..	..	..	..	..	..	..	..	..
15	Wick,	..	..	..	..	..	..	..	..	..
	East Coast Totals carried down,	37	892	51,690	1,808	..	13	1,821	59	53,570
	Orkney and Shetland.									
16	Orkney,	1	20	290	18	..	..	18	1	309
17	Shetland,	..	..	..	..	..	..	..	..	..
	Orkney and Shetland Totals carried down,	1	20	290	18	..	..	18	1	309
	WEST COAST.									
18	Stornoway,	..	..	..	..	..	..	..	..	..
19	Barra,	..	..	..	..	..	..	..	..	..
20	Loch Broom,	..	..	..	..	..	..	..	..	..
21	Loch Carron and Skye,	..	..	..	..	..	..	..	..	..
22	Fort William,	..	..	..	..	..	..	..	..	..
23	Campbeltown,	..	..	..	..	..	..	..	..	..
24	Inveraray,	..	..	..	..	..	..	..	..	..
25	Rothesay,	..	..	..	..	..	..	..	..	..
26	Greenock,	..	..	..	..	..	..	..	..	..
27	Ballantrae,	..	..	..	..	..	..	..	..	..
	West Coast Totals carried down,	..	..	..	..	..	..	..	..	..
	Totals brought down.									
	East Coast,	37	892	51,690	1,808	..	13	1,821	59	53,570
	Orkney and Shetland,	1	20	290	18	..	..	18	1	309
	West Coast,	..	..	..	..	..	..	..	..	..
	Grand Totals for 1893,	38	912	51,980	1,826	..	13	1,839	60	53,879
	Grand Totals for 1892,	44	1,089	48,805	1,724	..	12	1,736	40	50,581
	Increase in 1893,	..	..	3,175	102	..	1	103	20	3,298
	Decrease in 1893,	6	177	..	..	..	..	..	..	..

No. I.

of persons engaged in the Capture of Fish off the Scottish Coasts; the Total Number, ployed; and the total extent and value of Fishing Gear.

(EXCLUDING BEAM-TRAWLERS).

Propelled by Steam.						DISTRICTS.	No.
Length of Lines.				Buoy Ropes.	Number of Fishermen and Boys.		
Great.	Small.	Hand.	Total.				
Yds.	Yds.	Yds.	Yds.	Yds.		**EAST COAST.**	
..	..	..	..	..	..	Eyemouth.	1
268,800	..	2,400	271,200	2,520	98	Leith.	2
204,000	..	3,500	207,500	4,750	52	Anstruther.	3
..	..	..	..	..	..	Montrose.	4
..	..	..	..	..	..	Stonehaven.	5
411,840	..	..	411,840	9,360	95	Aberdeen.	6
25,200	..	..	25,200	..	8	Peterhead.	7
..	..	..	..	..	..	Fraserburgh.	8
..	..	..	..	..	..	Banff.	9
..	..	..	..	..	..	Buckie.	10
..	..	..	..	..	..	Findhorn.	11
..	..	..	..	..	..	Cromarty.	12
..	..	..	..	..	..	Helmsdale.	13
..	..	..	..	..	..	Lybster.	14
..	..	..	..	..	..	Wick.	15
909,840	..	5,900	915,740	16,630	253	East Coast Totals carried down.	
						Orkney and Shetland.	
12,960	..	..	12,960	620	6	Orkney.	16
..	..	..	..	..	..	Shetland.	17
12,960	..	..	12,960	620	6	Orkney and Shetland Totals carried down.	
						WEST COAST.	
..	..	..	..	..	..	Stornoway.	18
..	..	..	..	..	..	Barra.	19
..	..	..	..	..	..	Loch Broom.	20
..	..	..	..	..	..	Loch Carron and Skye	21
..	..	..	..	..	..	Fort William.	22
..	..	..	..	..	..	Campbeltown.	23
..	..	..	..	..	..	Inveraray.	24
..	..	..	..	..	..	Rothesay.	25
..	..	..	..	..	..	Greenock.	26
..	..	..	..	..	..	Ballantrae.	27
..	..	..	..	..	..	West Coast Totals carried down.	
						Totals brought down.	
909,840	..	5,900	915,740	16,630	253	East Coast.	
12,960	..	..	12,960	620	6	Orkney and Shetland.	
..	..	..	..	..	..	West Coast.	
922,800	..	5,900	928,700	17,250	259	Grand Totals for 1893.	
882,360	..	5,640	888,000	..	289	Grand Totals for 1892.	
40,440	..	260	40,700	..	..	Increase in 1893.	
..	..	..	..	..	30	Decrease in 1893.	

APPENDIX A.—

MEANS OF CAPTURE.—RETURN, for the year 1893, showing the Total Number Tonnage, and Value of the Boats and Vessels em-

No.	DISTRICTS.	FISHING BOATS AND VESSELS						
		Propelled by Sails or Oars.						
		Number.	Tonnage.	Value of Boats and Fishing Gear.				
				Boats.	Nets.			
					Drift.	Seine.	Other Kinds.	Total.
	EAST COAST.			£	£	£	£	£
1	Eyemouth,	173	2,017	11,329	10,823	..	..	10,823
2	Leith,	500	4,473	31,055	21,536	1,148	190	22,874
3	Anstruther,	696	9,515	46,389	64,724	..	751	65,475
4	Montrose,	602	6,359	40,104	18,375	..	100	18,475
5	Stonehaven,	194	1,834	11,365	7,678	..	..	7,678
6	Aberdeen,	255	2,565	12,454	11,640	..	..	11,640
7	Peterhead,	556	7,244	60,523	41,440	..	..	41,440
8	Fraserburgh,	605	8,179	48,822	42,250	..	..	42,250
9	Banff,	474	5,578	36,740	20,400	..	..	20,400
10	Buckie,	788	14,745	113,722	71,400	..	..	71,400
11	Findhorn,	372	5,741	46,095	36,835	..	..	36,835
12	Cromarty,	298	2,515	11,596	21,750	..	..	21,750
13	Helmsdale,	205	2,180	7,898	7,327	..	..	7,327
14	Lybster,	149	1,960	5,004	6,790	..	..	6,790
15	Wick,	704	7,060	31,437	33,140	..	..	33,140
	East Coast Totals carried down,	6,571	81,965	514,533	416,108	1,148	1,041	418,297
	Orkney and Shetland.							
16	Orkney,	673	3,242	11,886	8,230	..	..	8,230
17	Shetland,	808	5,781	29,247	21,040	..	..	21,040
	Orkney and Shetland Totals carried down.	1,481	9,023	41,133	29,270	..	..	29,270
	WEST COAST.							
18	Stornoway,	1,084	6,781	22,795	8,647	..	..	8,647
19	Barra,	329	1,471	4,310	3,524	..	..	3,524
20	Loch Broom,	543	2,501	6,349	9,960	..	..	9,960
21	Loch Carron and Skye,	948	3,235	7,526	22,112	..	..	22,112
22	Fort William,	405	1,284	4,557	2,323	104	50	2,477
23	Campbeltown,	566	2,596	8,326	5,064	3,300	..	8,364
24	Inveraray,	383	1,880	13,764	6,459	4,345	..	10,804
25	Rothesay,	222	750	3,202	4,937	60	10	5,007
26	Greenock,	290	704	2,899	3,925	..	..	3,925
27	Ballantrae,	450	1,218	6,880	5,486	..	1,306	6,792
	West Coast Totals carried down,	5,220	22,420	80,608	72,437	7,809	1,366	81,612
	Totals brought down.							
	East Coast,	6,571	81,965	514,533	416,108	1,148	1,041	418,297
	Orkney and Shetland,	1,481	9,023	41,133	29,270	..	..	29,270
	West Coast,	5,220	22,420	80,608	72,437	7,809	1,366	81,612
	Grand Totals for 1893,	13,272	113,408	636,274	517,815	8,957	2,407	529,179
	Grand Totals for 1892,	13,635	112,894	644,475	..	..	..	598,459
	Increase in 1893,	..	514	..	..	..	..	..
	Decrease in 1893,	363	..	8,201	..	..	..	69,280

No. 1.—*continued.*

of persons engaged in the Capture of Fish off the Scottish Coasts; the Total Number, ployed; and the total extent and value of Fishing Gear.

(EXCLUDING BEAM-TRAWLERS.)

Propelled by Sails or Oars.							
Value of Boats and Fishing Gear.							No.
Lines.				Bush and Buoy Ropes, and Stoppers.	Crab and Lobster Creels.	Grand Total.	
Great.	Small.	Hand.	Total.				
£	£	£	£	£	£	£	
156	3,489	21	3,666	575	690	27,083	1
1,036	5,355	21	6,412	3,508	586	64,435	2
5,349	3,941	165	9,455	7,062	1,393	129,774	3
3,380	7,322	288	10,990	2,719	953	73,241	4
835	2,400	39	3,274	781	255	23,353	5
396	3,869	32	4,297	572	110	29,073	6
2,980	7,962	42	10,984	2,184	22	115,153	7
6,956	8,640	78	15,674	1,345	524	108,615	8
4,240	2,745	123	7,108	4,743	540	69,531	9
6,861	6,861	29	13,751	36,064	74	235,011	10
1,587	3,879	80	5,546	7,604	33	96,113	11
120	2,509	39	2,668	1,861	121	37,996	12
236	1,522	62	1,820	269	70	17,384	13
525	258	37	820	188	14	12,816	14
1,480	1,723	100	3,303	572	330	68,782	15
36,137	62,475	1,156	99,768	70,047	5,715	1,108,360	
216	176	345	737	309	1,478	22,640	16
4,096	975	220	5,291	820	..	56,398	17
4,312	1,151	565	6,028	1,129	1,478	79,038	
6,286	2,773	155	9,214	2,578	536	43,770	18
1,376	535	49	1,960	1,402	1,690	12,886	19
789	434	183	1,406	99	620	18,434	20
2,005	661	..	2,666	545	311	33,160	21
421	344	43	808	386	466	8,694	22
664	678	65	1,407	618	606	19,321	23
216	435	42	693	640	202	26,103	24
..	284	19	303	192	45	8,749	25
72	639	29	740	727	75	8,366	26
1,074	546	163	1,783	273	112	15,840	27
12,903	7,329	748	20,980	7,460	4,663	195,323	
36,137	62,475	1,156	99,768	70,047	5,715	1,108,360	
4,312	1,151	565	6,028	1,129	1,478	79,038	
12,903	7,329	748	20,980	7,460	4,663	195,323	
53,352	70,955	2,469	126,776	78,636	11,856	1,382,721	
..	..	..	125,867	..	..	1,368,801	
..	..	..	909	..	..	13,920	
..	..	..	..	..	..	..	

APPENDIX A.—

MEANS OF CAPTURE.—RETURN, for the year 1893, showing the Total Number Tonnage, and Value of the Boats and Vessels em-

No.	DISTRICTS.	FISHING BOATS AND VESSELS			
		Propelled by Sails or Oars.			
		Area of Netting.			
		Drift.	Seine.	Other Kinds.	Total.
	EAST COAST.	Sq. Yds.	Sq. Yds.	Sq. Yds.	Sq. Yds.
1	Eyemouth,	3,126,500	..	..	3,126,500
2	Leith,	5,172,000	198,400	70,200	5,440,600
3	Anstruther,	20,140,800	..	22,680	20,163,480
4	Montrose,	4,777,500	..	2,800	4,780,300
5	Stonehaven,	1,848,000	..	..	1,848,000
6	Aberdeen,	4,179,000	..	..	4,179,000
7	Peterhead,	12,432,000	..	..	12,432,000
8	Fraserburgh,	8,450,000	..	..	8,450,000
9	Banff,	6,120,000	..	..	6,120,000
10	Buckie,	28,560,000	..	..	28,560,000
11	Findhorn,	13,990,800	..	..	13,990,800
12	Cromarty,	4,820,000	..	..	4,820,000
13	Helmsdale,	3,129,750	..	..	3,129,750
14	Lybster,	2,475,000	..	..	2,475,000
15	Wick,	10,140,840	..	..	10,140,840
	East Coast Totals carried down,	129,362,190	198,400	95,680	129,656,270
	Orkney and Shetland.				
16	Orkney	3,294,000	..	..	3,294,000
17	Shetland	5,260,000	..	..	5,260,000
	Orkney and Shetland Totals carried down,	8,554,000	..	..	8,554,000
	WEST COAST.				
18	Stornoway,	4,293,000	..	..	4,293,000
19	Barra,	881,000	..	..	881,000
20	Loch Broom,	2,490,000	..	..	2,490,000
21	Loch Carron and Skye,	5,528,000	..	..	5,528,000
22	Fort William,	944,000	9,600	12,800	966,400
23	Campbeltown,	1,688,000	660,000	..	2,348,000
24	Inveraray,	1,931,000	871,000	..	2,802,000
25	Rothesay,	1,833,000	20,000	5,000	1,858,000
26	Greenock,	1,309,200	..	..	1,309,200
27	Ballantrae,	1,736,960	..	243,887	1,980,847
	West Coast Totals carried down,	22,634,160	1,560,600	261,687	24,456,447
	Totals brought down.				
	East Coast,	129,362,190	198,400	95,680	129,656,270
	Orkney and Shetland,	8,554,000	..	..	8,554,000
	West Coast,	22,634,160	1,560,600	261,687	24,456,447
	Grand Totals for 1893,	160,550,350	1,759,000	357,367	162,666,717
	Grand Totals for 1892,	..	..	..	169,882,038
	Increase in 1893,	..	..	..	..
	Decrease in 1893,	..	..	..	7,215,321

No. I.—*continued.*

of persons engaged in the Capture of Fish off the Scottish Coasts: the Total Number, ployed; and the total extent and value of Fishing Gear.

(EXCLUDING BEAM-TRAWLERS).

Propelled by Sails or Oars.							No.
Length of Lines.				Bush and Buoy Ropes, and Stoppers.	Crab and Lobster Creels.	Number of Fishermen and Boys.	
Great.	Small.	Hand.	Total.				
Yds.	Yds.	Yds.	Yds.	Yds.	No.		
86,600	1,698,280	24,800	1,809,680	90,210	3,450	575	1
355,200	2,554,560	8,940	2,918,700	225,120	3,700	1,758	2
3,063,400	2,364,200	82,700	5,510,300	613,566	7,945	3,003	3
2,227,200	5,125,400	135,720	7,488,320	97,020	4,765	1,139	4
556,000	1,200,000	42,400	1,798,400	155,790	1,320	506	5
253,440	3,169,920	32,400	3,455,760	165,704	471	734	6
1,881,600	4,187,840	64,680	6,134,120	248,620	88	1,967	7
3,339,000	4,147,200	43,680	7,529,880	215,200	2,620	1,954	8
1,780,800	1,117,200	146,880	3,044,880	279,600	1,760	1,552	9
4,116,600	4,116,600	71,400	8,304,600	3,973,463	370	3,731	10
914,400	2,233,440	63,660	3,211,500	803,750	265	1,987	11
76,800	1,212,480	23,400	1,312,680	199,680	810	1,069	12
222,400	919,300	54,900	1,196,600	63,150	686	693	13
383,760	147,600	39,680	571,040	22,500	72	649	14
712,000	830,000	96,000	1,638,000	229,000	1,650	2,924	15
19,969,200	35,024,020	931,240	55,924,460	7,382,373	29,972	24,241	
155,520	143,560	261,800	560,880	61,256	9,845	1,707	16
4,049,400	702,000	213,120	4,964,520	419,120	..	2,984	17
4,204,920	845,560	474,920	5,525,400	480,376	9,845	4,691	
4,371,360	2,661,880	375,800	7,409,040	301,940	5,360	4,581	18
536,400	28,150	37,920	602,470	431,936	9,650	1,084	19
227,820	189,200	135,280	552,300	49,700	4,128	1,882	20
799,425	266,475	..	1,065,900	187,320	1,555	2,365	21
208,560	156,130	27,240	391,930	75,414	2,510	913	22
258,800	257,700	26,400	542,900	168,956	3,450	1,486	23
129,600	182,400	17,580	329,580	247,510	578	974	24
..	132,000	12,000	144,000	21,120	223	392	25
63,360	386,200	19,260	468,820	68,700	500	425	26
521,600	335,400	36,590	893,590	89,410	1,560	832	27
7,116,925	4,595,535	688,070	12,400,530	1,642,006	29,514	14,934	
19,969,200	35,024,020	931,240	55,924,460	7,382,373	29,972	24,241	
4,204,920	845,560	474,920	5,525,400	480,376	9,845	4,691	
7,116,925	4,595,535	688,070	12,400,530	1,642,006	29,514	14,934	
31,291,045	40,465,115	2,094,230	73,850,390	9,504,755	69,331	43,866	
..	..	..	68,544,582	..	..	45,555	
.	..	..	5,305,808	..	..	..	
..	..	..	..	..	..	1,883	

APPENDIX A.—

MEANS OF CAPTURE.—RETURN, for the year 1893, showing the Total Number Tonnage, and Value of the Boats and Vessels em-

BEAM-

No.	DISTRICTS.	Propelled by Steam.											
		Scottish.						Other than Scottish.					
		Number.	Tonnage.	Value.			Men Engaged.	Number.	Tonnage.	Value.			Men Engaged
				Vessels.	Fishing Gear.	Total.				Vessels.	Fishing Gear.	Total.	
	EAST COAST.			£	£	£				£	£	£	
1	Eyemouth,	..	..	..	..	..	..	..	..	..	..	..	..
2	Leith,	26	930	82,400	3,120	85,520	189	..	..	..	..	..	..
3	Anstruther,	2	79	6,300	316	6,616	16	..	..	..	..	..	..
4	Montrose,	5	221	10,200	500	10,700	36	2	118	6,000	200	6,200	14
5	Stonehaven,	..	..	..	..	..	..	..	..	..	..	..	..
6	Aberdeen,	38	1,356	133,304	6,720	140,024	294	37	841	86,100	3,650	89,750	282
7	Peterhead,	..	..	..	..	..	..	..	..	..	..	..	..
8	Fraserburgh,	1	39	4,800	90	4,890	9	..	..	..	..	..	..
9	Banff,	..	..	..	..	..	..	..	..	..	..	..	..
10	Buckie,	..	..	..	..	..	..	..	..	..	..	..	..
11	Findhorn,	..	..	..	..	..	..	..	..	..	..	..	..
12	Cromarty,	..	..	..	..	..	..	..	..	..	..	..	..
13	Helmsdale,	..	..	..	..	..	..	..	..	..	..	..	..
14	Lybster,	..	..	..	..	..	..	..	..	..	..	..	..
15	Wick,	..	..	..	..	..	..	..	..	..	..	..	..
	East Coast Totals carried down,	72	2,625	237,004	10,746	247,750	544	39	959	92,100	3,850	95,950	296
	Orkney and Shetland.												
16	Orkney,	..	..	..	..	..	..	..	..	..	..	..	..
17	Shetland,	..	..	..	..	..	..	..	..	..	..	..	..
	Orkney and Shetland Totals carried down,	..	..	..	..	..	..	..	..	..	..	..	..
	WEST COAST.												
18	Stornoway,	..	..	..	..	..	..	..	..	..	..	..	..
19	Barra,	..	..	..	..	..	..	..	..	..	..	..	..
20	Loch Broom,	..	..	..	..	..	..	..	..	..	..	..	..
21	Loch Carron and Skye,	..	..	..	..	..	..	..	..	..	..	..	..
22	Fort William,	..	..	..	..	..	..	..	..	..	..	..	..
23	*Campbeltown,	..	..	..	..	..	..	..	..	..	..	..	..
24	Inveraray,	..	..	..	..	..	..	..	..	..	..	..	..
25	Rothesay,	..	..	..	..	..	..	..	..	..	..	..	..
26	Greenock,	..	..	..	..	..	..	..	..	..	..	..	..
27	Ballantrae,	..	..	..	..	..	..	..	..	..	..	..	..
	West Coast Totals carried down,	..	..	..	..	..	..	..	..	..	..	..	..
	Totals brought down.												
	East Coast,	72	2,625	237,004	10,746	247,750	544	39	959	92,100	3,850	95,950	296
	Orkney and Shetland,	..	..	..	..	..	..	..	..	..	..	..	..
	West Coast,	..	..	..	..	..	..	..	..	..	..	..	..
	Grand Totals for 1893,	72	2,625	237,004	10,746	247,750	544	39	959	92,100	3,850	95,950	296
	Grand Totals for 1892,	70	2,543	219,854	10,820	230,674	532	48	1,654	96,380	6,380	102760	366
	Increase in 1893,	2	82	17,150	..	17,076	12	..	..	..	..	..	..
	Decrease in 1893,	..	..	..	74	..	..	9	695	4,280	2,530	6,810	70

Note.—The Returns relating to *Scottish* Trawlers are compiled according to the Creeks to

* In addition to those given, three sailing beam-trawl vessels belong to this district,

No. I.—*continued.*

of persons engaged in the Capture of Fish off the Scottish Coasts ; the Total Number, ployed ; and the total extent and value of Fishing Gear.

TRAWL -VESSELS.

Propelled by Sails. Scottish.						Grand Total.						No.
Number.	Tonnage.	Value.			Men Engaged.	Number.	Tonnage.	Value.			Men Engaged.	
		Vessels.	Fishing Gear.	Total.				Vessels.	Fishing Gear.	Total.		
		£	£	£				£	£	£		
..	..	..	..	..	..	..	..	..	..	..	..	1
..	..	..	..	..	..	26	930	82,400	3,120	85,520	189	2
..	..	..	..	..	..	2	79	6,300	316	6,616	16	3
..	..	..	..	..	..	7	339	16,200	700	16,900	50	4
..	..	..	..	..	..	..	..	..	..	..	..	5
..	..	..	..	..	..	75	2,197	219,404	10,370	229,774	576	6
..	..	..	..	..	..	..	..	..	..	..	..	7
..	..	..	..	..	..	1	39	4,800	0	4,890	9	8
..	..	..	..	..	..	..	..	..	..	..	..	9
..	..	..	..	..	..	..	..	..	..	..	..	10
..	..	..	..	..	..	..	..	..	..	..	..	11
..	..	..	..	..	..	..	..	..	..	..	..	12
..	..	..	..	..	..	..	..	..	..	..	..	13
..	..	..	..	..	..	..	..	..	..	..	..	14
..	..	..	..	..	..	..	..	..	..	..	..	15
..	..	..	..	..	..	111	3,584	329,104	14,596	343,700	840	
..	..	..	..	..	..	..	..	..	..	..	..	16
..	..	..	..	..	..	..	..	..	..	..	..	17
..	..	..	..	..	..	..	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	18
..	..	..	..	..	..	..	..	..	..	..	..	19
..	..	..	..	..	..	..	..	..	..	..	..	20
..	..	..	..	..	..	..	..	..	..	..	..	21
..	..	..	..	..	..	..	..	..	..	..	..	22
..	..	..	..	..	..	..	..	..	..	..	..	23
..	..	..	..	..	..	..	..	..	..	..	..	24
2	12	50	28	78	6	2	12	50	28	7	6	25
17	105	408	284	692	68	17	105	408	284	6	68	26
51	306	3,275	1,020	4,295	102	51	306	3,275	1,020	4,282	102	27
70	423	3,733	1,332	5,065	176	70	423	3,733	1,332	5	176	
..	..	..	..	..	..	111	3,584	329,104	14,596	343,700	840	
..	..	..	..	..	..	..	..	..	..	..	..	
70	423	3,733	1,332	5,065	176	70	423	3,733	1,332	5,065	176	
70	423	3,733	1,332	5,065	176	181	4,007	332,837	15,928	348,765	1,016	
65	393	2,403	1,127	3,530	168	183	4,590	318,637	18,327	336,964	1,066	
5	30	1,330	205	1,535	8	..	..	14,200	..	11,801	..	
..	..	..	..	..	..	2	583	..	2,399	..	50	

which they belong ; but, in the case of others, according to the Creeks from which they fish.
which, owing to the prohibition of trawling there, were not used during the year.

APPENDIX A.—

MEANS OF CAPTURE.—RETURN, for the year 1893, showing the Total Number Tonnage, and Value of the Boats and Vessels em-

No.	DISTRICTS.	FISHING BOATS AND Propelled by Steam, Sails, or Oars.				
		Number.	Tonnage.	Value.		
				Boats and Vessels.	Fishing Gear.	Total.
	EAST COAST.			£	£	£
1	Eyemouth,	173	2,017	11,329	15,754	27,083
2	Leith,	539	5,763	126,455	37,302	163,757
3	Anstruther,	708	9,720	64,049	84,080	148,129
4	Montrose,	609	6,698	56,304	33,837	90,141
5	Stonehaven,	194	1,834	11,365	11,988	23,353
6	Aberdeen,	343	5,097	256,188	27,648	283,836
7	Peterhead,	557	7,315	63,523	54,670	118,193
8	Fraserburgh,	606	8,218	53,622	59,883	113,505
9	Banff,	474	5,578	36,740	32,791	69,531
10	Buckie,	788	14,745	113,722	121,289	235,011
11	Findhorn,	372	5,741	46,095	50,018	96,113
12	Cromarty,	298	2,515	11,596	26,400	37,996
13	Helmsdale,	205	2,180	7,898	9,486	17,384
14	Lybster,	149	1,960	5,004	7,812	12,816
15	Wick,	704	7,060	31,437	37,345	68,782
	East Coast Totals carried down,	6,719	86,441	895,327	610,303	1,505,630
	Orkney and Shetland.					
16	Orkney,	674	3,262	12,176	10,773	22,949
17	Shetland,	808	5,781	29,247	27,151	56,398
	Orkney and Shetland Totals carried down,	1,482	9,043	41,423	37,924	79,347
	WEST COAST.					
18	Stornoway,	1,084	6,781	22,795	20,975	43,770
19	Barra,	329	1,471	4,310	8,576	12,886
20	Loch Broom,	543	2,501	6,349	12,085	18,434
21	Loch Carron and Skye,	948	3,235	7,526	25,634	33,160
22	Fort William,	405	1,284	4,557	4,137	8,694
23	Campbeltown,	566	2,596	8,326	10,995	19,321
24	Inveraray,	383	1,880	13,764	12,339	26,103
25	Rothesay,	224	762	3,252	5,575	8,827
26	Greenock,	307	809	3,307	5,751	9,058
27	Ballantrae,	501	1,524	10,155	9,980	20,135
	West Coast Totals carried down,	5,290	22,843	84,341	116,047	200,388
	Totals brought down.					
	East Coast,	6,719	86,441	895,327	610,303	1,505,630
	Orkney and Shetland,	1,482	9,043	41,423	37,924	79,347
	West Coast,	5,290	22,843	84,341	116,047	200,388
	Grand Totals for 1893,	13,491	118,327	1,021,091	764,274	1,785,365
	Grand Totals for 1892,	13,862	118,573	1,011,917	744,883	1,756,800
	Increase in 1893,	..	..	9,174	19,391	28,565
	Decrease in 1893,	371	246	..	..	..

No. I.—*continued.*

of persons engaged in the Capture of Fish off the Scottish Coasts; the Total Number, ployed; and the total extent and value of Fishing Gear.

BEAM-TRAWL VESSELS.

Propelled by Steam, Sails, or Oars.				DISTRICTS.	No.
Area of Nets.	Length of Lines (including Buoy Ropes, &c.)	Crab and Lobster Creels.	Number of Men Engaged.		
Sq. Yds.	Yds.	No.		**EAST COAST.**	
3,126,500	1,899,890	3,450	575	Eyemouth.	1
5,440,600	3,417,540	3,700	2,045	Leith.	2
20,163,480	6,336,116	7,945	3,071	Anstruther.	3
4,780,300	7,585,340	4,765	1,189	Montrose.	4
1,848,000	1,954,190	1,320	506	Stonehaven.	5
4,179,000	4,042,664	471	1,405	Aberdeen.	6
12,432,000	6,407,940	88	1,975	Peterhead.	7
8,450,000	7,745,080	2,620	1,963	Fraserburgh.	8
6,120,000	3,324,480	1,760	1,552	Banff.	9
28,560,000	12,278,063	370	3,731	Buckie.	10
13,990,800	4,015,250	265	1,987	Findhorn.	11
4,820,000	1,512,360	810	1,069	Cromarty.	12
3,129,750	1,259,750	686	693	Helmsdale.	13
2,475,000	593,540	72	649	Lybster.	14
10,140,840	1,867,000	1,650	2,924	Wick.	15
129,656,270	64,239,203	29,972	25,334	East Coast Totals carried down.	
				Orkney and Shetland.	
3,294,000	635,716	9,845	1,713	Orkney.	16
5,260,000	5,383,640	..	2,984	Shetland.	17
8,554,000	6,019,356	9,845	4,697	Orkney and Shetland Totals carried down.	
				WEST COAST.	
4,293,000	7,710,980	5,360	4,581	Stornoway.	18
881,000	1,034,406	9,650	1,084	Barra.	19
2,490,000	602,000	4,128	1,882	Loch Broom.	20
5,528,000	1,253,220	1,555	2,365	Loch Carron and Skye.	21
966,400	467,344	2,510	913	Fort William.	22
2,348,000	711,856	3,450	1,486	Campbeltown.	23
2,802,000	577,090	578	974	Inveraray.	24
1,858,000	165,120	223	398	Rothesay.	25
1,309,200	537,520	500	493	Greenock.	26
1,980,847	983,000	1,560	934	Ballantrae.	27
24,456,447	14,042,536	29,514	15,110	West Coast Totals carried down.	
				Totals brought down.	
129,656,270	64,239,203	29,972	25,334	East Coast.	
8,554,000	6,019,356	9,845	4,697	Orkney and Shetland.	
24,456,447	14,042,536	29,514	15,110	West Coast.	
162,666,717	84,301,095	69,331	45,141	Grand Totals for 1893.	
169,882,038	69,432,582	..	46,910	Grand Totals for 1892.	
..	14,868,513	..	..	Increase in 1893.	
7,215,321	..	..	1,769	Decrease in 1893.	

APPENDIX A.—

RETURN showing Particulars regarding the State of the Fisheries at each

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
* *Eyemouth District.*															
Amble (Northumberland),	4	48	2	6	1	2	7	56	.	.	.	18	.	15	Herring drift-net and lines.
Alnmouth ,,	.	.	10	50	1	2	11	52	.	.	1	2	.	14	Line and crab creels.
Boulmer ,,	1	12	22	132	3	6	26	150	.	.	2	34	.	44	,,
Craster ,,	11	132	23	138	6	12	40	282	.	.	.	10	1	56	Herring drift-net, line and crab creels.
Newton ,,	5	60	13	78	1	2	19	140	.	.	3	26	2	27	,,
Beadnell ,,	9	135	17	102	3	6	29	243	1	6	.	.	3	43	,,
N. Sunderland ,,	12	180	18	108	9	18	39	306	.	.	2	30	1	60	,,
Holy Island ,,	5	75	18	108	10	20	33	203	.	.	5	62	1	78	,,
Spittal ,,	4	72	11	66	5	10	20	148	.	.	2	9	1	56	,,
Berwick ,,	13	234	26	156	5	10	44	400	2	.	.	8	.	86	,,
Burnmouth (Berwickshire),	16	320	5	30	25	50	46	400	2	.	.	10	1	108	,,
Eyemouth ,,	52	1,040	11	55	13	26	76	1,121	.	.	3	72	2	305	Herring drift-net and line.
Coldingham ,,	18	360	14	98	19	38	51	496	3	.	.	23	2	82	Herring drift-net, line and crab creels.
Totals, .	150	2,668	190	1,127	101	202	441	3,997	8	6	18	304	14	974	
Leith District.															
Cove (Berwickshire),	.	.	16	64	.	.	16	64	.	.	2	26	.	21	Crab creels, lines and nets.
Dunbar (Haddington shire),	7	140	40	160	.	.	47	300	.	.	3	10	1	150	,,
North Berwick ,,	1	15	19	76	.	.	20	91	.	.	3	15	1	45	,,
Port Seton and Cockenzie (Haddingtonshire),	61	1,525	42	210	.	.	103	1,735	.	.	.	23	.	448	Nets, small lines, and dredging.
Prestonpans ,,	5	125	6	30	.	.	11	155	.	.	1	31	.	95	,,
Fisherrow (Edinburgh),	26	650	17	85	.	.	43	735	.	.	1	42	.	285	Nets, great small lines, &c.
Leith ,,	7	210	1	5	5	5	13	220	1	.	.	40	.	63	Great lines.
Carry forward, .	107	2,665	141	630	5	5	253	3,300	1	.	10	187	2	1,107	nets, and dredging.

* Value of fish landed at English Stations in this district are collected by Board of Trade and included in the English returns.
Note.—In addition to the above, there were 26 trawlers fishing from Leith and Granton, all of which were propelled by steam.

No. II.

Fishing Creek or Station on the Scottish Coasts during the Year 1893.

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
Aug. 1st to Sept. 10th.	Sept. 1st to July 20th.	2 to 10 miles off Station.	.	Herring.	Middling.	2	Average	The number of herring fishing boats belonging to the various Stations has greatly fallen off within recent years, not on account of any decrease in the catch of herrings, but owing to the unremunerative prices,—which, since 1887 have averaged only from 7s. to 12s. 6d. a cran annually, with the exception of 1889, when the price was 22s. 6d. In 1884 the number of first class or herring boats in the district was 292, whilst for 1893 it was only 150. For a good many years past the numbers of second and third class boats have remained about the same.
.	All the year.	,,	.	Haddocks and crabs.	Excellent.	.	,,	
.	,,	,,	.	Haddocks, codling and crabs.	,,	1	,,	
July 1st to Sept. 20th.	Oct. 1st to June 30th.	2 to 12 miles off Station.	.	Herrings, haddocks, codling and crabs.	Herrings middling, other kinds good.	3	,,	
,,	,,	,,	.	Crabs.	Fair.	.	,,	
,,	,,	,,	.	Haddocks, codling and crabs.	Good, but crabs fair.	.	,,	
,,	,,	2 to 15 miles off Station.	.	Herrings, haddocks, codling and crabs.	Herrings middling, also crabs, other kinds excellent.	8	,,	
,,	,,	2 to 15 miles off Station and off Farne Islands.	.	,,	,,	1	,,	
,,	,,	2 to 20 miles off Station and off Farne Islands.	.	,,	Herrings, haddocks, crabs middling, other kinds good.	4	Below average.	
June 1st to Sept. 20th.	,,	,,	.	,,	,,	10	,,	
,,	Oct. 1st to Apr. 30th.	,,	3,788	Herrings, haddocks, codling and whiting, crabs.	,,	1	,,	
May 1st to Sept. 20th.	,,	10 to 30 miles off Station and off Farne Islands.	25,723	,,	,,	22	,,	
,,	,,	1 to 15 miles off Station and off Farne Islands.	1,291	Crabs and lobsters.	Crabs middling, lobsters good.	.	,,	
			30,802			52		
Irregular.	Year round.	Semi-radius of about 6 miles.	2,912	Crabs, haddock, whiting, &c.	Crabs fair, others good.	.	Decreasing.	Two crews and two boats have left for Findochty, Banffshire.
1st Jan. to 31st Mar., 15th June to 8th Sept.	,,	Firth of Forth, and off Farne Islands.	10,270	Crab, herring, haddock, &c.	,,	10	Declining.	
Irregular.	,,	Firth of Forth.	1,737	Haddock, crab, cod, &c.	,,	.	,,	
1st May to 15th Dec.	,,	Ireland, Lewis, Yarmouth, Shetland, &c., Firth of Clyde, Firth of Forth, and 40 miles off.	11,206	Haddock, cod, clam, herring, &c.	Haddocks fair, others good.	.	Average	
,,	,,	,,	1,915	,,	,,	.	Declining.	
Year round.	,,	,,	6,672	Haddock, cod, flounder, herring, &c.	,,	.	,,	
Irregular.	Irregular.	Chiefly off Aberdeen, &c.	771	Mussel, clam, &c.	Good.	3	,,	
			35,483			13		

Note.—In addition to the above, 2 trawlers made two landings of fish at Berwick, both of which were propelled by steam.

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	107	2,665	141	630	5	5	253	3,300	1	.	10	187	2	1,107	
Leith District—continued.															
Newhaven (Edinburgh),	15	300	101	505	3	3	119	808	.	.	19	404	13	410	Nets, lines, and dredging.
Granton ,,	6	150	1	6	.	.	7	156	.	.	.	30	.	49	Great lines.
Queensferry (Linlithgow),	.	.	6	24	.	.	6	24	.	.	.	6	.	22	Nets.
Boness ,,	.	.	2	8	.	.	2	8	.	.	.	2	.	6	,,
Grangemouth and Dunmore (Stirling),	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alloa, &c. (Clackmannan),	12	180	15	60	2	2	29	242	5	2	.	.	.	62	Nets.
Kincardine (Fife),	3	45	3	12	.	.	6	57	.	.	.	3	.	18	,,
Limekilns, &c. ,,	.	.	6	24	4	8	10	32	.	.	.	10	.	18	,,
Inverkeithing ,,	.	.	4	16	1	2	5	18	1	.	.	2	.	16	,,
Aberdour ,,	.	.	5	20	.	.	5	20	.	.	.	5	.	16	Nets and lines.
Burntisland ,,	.	.	5	20	3	6	8	26	.	.	.	8	.	20	,,
Kinghorn ,,	.	.	6	18	10	20	16	38	.	.	.	16	.	28	,,
Kirkcaldy ,,	.	.	2	6	23	46	25	52	.	.	.	25	.	40	,,
Dysart ,,	.	.	6	18	8	16	14	34	.	.	.	14	.	28	,,
Wemyss ,,	.	.	2	6	6	12	8	18	1	.	.	5	.	16	,,
Totals, . .	143	3,340	305	1,373	65	120	513	4,833	8	2	29	717	15	1,856	
Anstruther District.															
Buckhaven (Fife),	79	1,422	53	212	10	20	142	1,654	.	.	5	94	4	340	Net, line and crab.
Methil and Leven ,,	.	.	2	8	3	6	5	14	.	2		.	.	10	Line and crab.
Largo ,,	12	216	11	44	3	6	26	266	.	14	3	.	.	76	Line.
Elie and Earlsferry ,,	.	.	4	16	4	8	8	24	.	.	1	4	.	16	,,
St Monance ,,	72	1,584	13	65	.	.	85	1,649	.		2	44	.	370	Net and line.
Carry forward, .	163	3,222	83	345	20	40	266	3,607	.	16	11	142	4	812	

Note.—In addition to the above, there were 2 trawlers belonging to the district,

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
			35,483			13		
1st Jan. to 31st Mar., 15th May to 31st Dec.	Year round.	Firths of Forth and Clyde, Scotland, and off Farne Islands.	53,689	Haddock, cod, herring, sprat, &c.	Haddocks fair, others good.	5	Average	Fishing industry declining.
.	Irregular.	Chiefly off Aberdeen and Ireland.	34,583	Haddock, cod, plaice, &c.	,,	.	,,	
1st Jan. to 31st Mar., 1st Nov. to 31st Dec.	.	Upper Firth of Forth.	655	Herring, &c.	Good.	.	,,	
,,	.	,,	263	,,	,,	.	,,	
.	.	.	1,043	.	.	.	.	
1st Jan. to 31st Mar., 1st Nov. to 31st Dec.	Occasional.	Upper Firth of Forth.		Herring, sprat,[s] flounder, &c.	Good.	.	Average	
,,	,,	,,	642	,,	,,	.	,,	
Irregular.	Irregular.	,,	40	,,	,,	.	Declining.	Almost suspended.
,,	,,	,,	558	Herring, sprat, and shell fish.	,,	.	Average	,,
,,	Occasional.	,,	288	Herring, &c.	,,	.	,,	
,,	,,	,,	418	,,	,,	.	,,	
,,	Year round.	,,	593	Herring, cod, &c.	,,	.	,,	
Occasional.	Occasional.	,,	118	,,	,,	.	Declining.	
,,	Year round.	,,	533	Herring, haddock, &c.	Haddocks fair, others good.	.	Average	
,,	Irregular.	,,	47	,,	,,	.	,,	
			128,953			18		
Dec. and Jan.	Whole year, more or less.	Firth of Forth.	2,564	Haddock and codling.	Generally inferior.	.	Average	The fishermen fish herrings at Shields from May till September.
.	,,	,,	271	,,	,,	.	,,	Substitution of larger boat gives increased tonnage.
.	,,	,,	1,502	Haddock and flounder.	,,	.	,,	Larger boats instead of smaller accounts for increased tonnage. Most of fishermen fish herrings at northern stations.
.	,,	,,	580	Haddock and codling.	,,	.	,,	Sand eels are caught in May and June.
1st Jan. to 31st Mar.	,,	Haddock and herring, Firth of Forth. Cod, Firth of Forth, to 180 miles E. of May Island.	6,338	Cod, haddock and herring.	Cod good, haddock small in summer.	5	Cod and herring fishing above average	The most of the fishermen fish herrings at northern stations in summer, and part at Scarborough and Yarmouth in winter.
			11,255			5		

fishing from Aberdeen, which were propelled by steam.

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	163	3,222	83	345	20	40	266	3,607	.	16	11	142	4	812	
Anstruther District—continued.															
Pittenweem (Fife),	47	1,034	15	60	.	.	62	1,094	.	.	6	56	.	220	Net and line.
Anstruther and Cellardyke ,,	151	3,322	16	80	20	40	187	3,442	.	.	1	301	2	630	,,
Crail ,,	2	38	11	44	15	30	28	112	.	.	2	6	.	66	Line, crab and lobster.
Kingsbarns and Boarhills ,,	.	.	1	4	8	16	9	20	.	.	.		.	18	Crab and lobster.
St Andrews ,,	26	520	17	85	3	6	46	611	4	46	.	.	.	132	Net and line.
Tayport ,,	1	15	38	152	9	18	48	185	2	6	.	.	.	120	Mussel dredging.
Newburgh ,,	30	510	.	.	30	60	60	570	.	.	2	19	.	90	Bag-net.
Totals, .	420	8,661	181	770	105	210	706	9,641	6	68	22	524	6	2,088	
Montrose District.															
Dundee (Forfar),	2	36	.	.	.	.	2	36	.	.	.	.	.	22	Trawl, net and line.
Broughty Ferry ,,	29	580	28	112	66	132	123	824	.	.	.	.	.	184	Net and line.
Carry forward, .	31	616	28	112	66	132	125	860	.	.	.	.	.	206	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
			11,255			5		
1st Jan. to 31st Mar.	Whole year, more or less.	Haddock and herring, Firth of Forth. Cod, 30 to 200 miles E. of May Island.	3,054	Haddock and codling.	Fair till May, afterwards generally small.	3	Improvement in cod and herring fishing, haddock average.	The most of the fishermen fish herrings at northern ports in summer, and at England in winter. Bulk of cod and herring caught are landed at Anstruther.
1st Jan. to 31st Mar., and July and Aug.	1st Jan. to 30th June and Nov. and Dec.	Herrings, Firth of Forth in winter; summer, 20 to 30 miles E. of May. Cod, 30 to 200 miles, E. by N. to S.E. of May Island.	30,672	Herrings, cod, ling, halibut, skate and crabs.	Good except crabs, which were inferior.	14	Improvement in cod and herring fishings.	Fishermen fish herrings at northern ports in summer, and a number at England in September, October and November.
,,	Whole year more or less.	Vicinity of the May, and the coast around Fifeness.	2,936	Haddock, cod, crab and lobster.	Generally inferior.	.	Average	Part of the fishermen go north to the summer herring fishing.
,,	Feb. to Nov. inclusive (crab fishing season).	Inshore from Fifeness to near St Andrews.	744	Crabs and lobster.	Crabs inferior, lobster fair.	.	Little below average	Fishermen depend wholly on crab and lobster fishing, with occasional work on land.
No herring fishing at home.	Whole year more or less.	Bell Rock to May, and St Andrews Bay.	7,234	Haddock and flounder.	Fair beginning of year, inferior from May onwards.	2	,,	Part of the fishermen go north to the summer herring fishing. River Eden mussels are included in St Andrews total value.
.	Whole year.	Estuary of Tay.	2,151	Mussels only.	Fair.	.	Average	Four small steamers are employed dredging mussels. Some of the men are employed at salmon fishing in summer.
25th Sept. to 24th Feb.	.	River Tay.	1,389	Sparling.	Inferior beginning of year, good at end of year.	.	No sprats got.	Fishermen are salmon fishers during salmon fishing season.
			59,435			24		
At intervals during Nov., Dec. and Jan.	No white fishing by lines.	The Tay for herrings. Trawling from 4 to 30 miles, S.E.	7,902	Haddocks, cod and flat-fish.	Haddocks small, other fish good.	.	Favourable.	Herring and sprat fishing a failure. A slight increase on the trawl fish landed.
,,	From Sept. to the end of June.	From 6 to 15 miles off in winter; in summer 20 to 40 miles, S.E.	6,341	Haddocks, plaice and flounder.	Fair.	.	Poor.	The great falling off is attributed to beam trawling.
			14,243			.		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	31	616	28	112	66	132	125	860	.	.	.	.	.	206	
Montrose District—continued.															
Westhaven (Forfar),	.	.	2	8	4	4	6	12	.	.	2	12	.	12	Line and lobster fishing.
Easthaven ,,	.	.	2	8	7	14	9	22	.	.	.	.	.	12	,,
Arbroath ,,	51	816	44	176	7	14	102	1,006	2	10	.	.		179	Net and line.
Auchmithie ,,	8	128	25	100	2	4	35	232	.	.	1	4	4	56	Line and lobster fishing.
Usan ,,	2	32	5	25	2	4	9	61	.	18	.	.	.	26	,,
Ferryden ,,	74	1,924	35	210	38	76	147	2,210	.	1,016	3	.	.	285	Net and line.
Montrose ,,	.	.	.	.	7	14	7	14	.	.	7	14	.	35	Trawl, net and line.
Milton (Kincardine),	.	.	.	.	2	4	2	4	.	.	1	2	.	3	Lines and lobster creels.
Johnshaven ,,	20	400	21	126	11	22	52	548	1	158	.	.	.	90	Net and lines.
Gourdon ,,	57	1,140	37	222	14	28	108	1,390	.	384	13	.	.	265	,,
Totals, .	243	5,056	199	987	160	316	602	6,359	3	1,586	27	32	4	1,175	

Note.— In addition to the above, there were 3 trawlers fishing from Montrose and 4 from

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
			14,243			.		
At intervals during Nov., Dec. and Jan.	From Sept. to Feb.	6 to 12 miles E. and S.E.	335	Haddocks and codling.	Good.	.	Fair.	The fishermen engage in salmon fishing for 6 months in the year.
,,	,,	,,	428	,,	,,	.	,,	Nearly all the fishermen engage in salmon fishing for 6 months in the year.
1st July to end of August.	10 months in the year.	10 to 20 miles S.E. in winter, 20 to 40 in summer.	15,576	Herring, codling and haddock.	,,	3	Decrease in herring, but increase in haddock.	Prices of fish rule high, as fishermen's wives compete at sales by auction.
,,	,,	,,	2,794	Haddocks and codling.	Fair.	.	Poor.	Notwithstanding the new harbour built, a few fishermen are yearly leaving for Arbroath.
,,	,,	,,	534	,,	,,	.	Little below average.	The fishing industry has been almost at a standstill during the past few years.
,,	,,	6 to 20 miles E. and S.E. in winter, in summer 20 to 60 miles.	1,378	All the fish landed at Montrose.	Herrings good, white fish small.	.	A great falling off in white fish.	On account of poor price for herring and scarcity of white fish, young fishermen are engaging in other occupations.
,,	All the year round.	6 to 12 miles E. and S.E. in summer, 20 to 60 in winter.	30,605	Herring, haddocks, sole and plaice.	Herrings good, haddocks small.	[illegible]	Herring fishing better, white fishing poorer.	The Ferryden fishermen land their fish daily at Montrose.
,,	,,	4 to 10 miles S.E.	100	Haddock and codling.	Fair.	.	Poor.	On the decline yearly.
,,	10 months in the year.	4 to 10 miles in summer, and 20 to 30 in winter S.S.E.	4,401	Herring, haddocks and codling.	Herrings good, haddocks small.	3	Below average.	No progress in fishing for the past few years. About 40 fishermen are at salmon fishing for 6 months in the year.
,,	,,	6 to 20 miles in winter, and from 20 to 60 in summer E. and S.E.	17,032	,,	Good.	6	Fair.	The fishermen are persevering and industrious.
			87,426			15		

Dundee, all propelled by steam. Two of the 4 from Dundee were English vessels.

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
Stonehaven District.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Shieldhill (Kincardine),	.	.	2	8	5	10	7	18	.	.	.	6	.	9	Lines and creels.
Catterline ,,	7	84	4	24	12	24	23	132	.	.	3	14	.	38	Nets, lines and creels.
Crawton ,,	1	21	2	8	5	10	8	39	.	.	2	8	.	10	,,
Stonehaven ,,	78	1,170	26	104	16	32	120	1,306	.	9	1	.	2	345	,,
Cowie ,,	7	112	5	20	4	8	16	140	.	.	1	4	.	35	,,
Skateraw ,,	12	180	1	5	7	14	20	199	.	.	1	15	.	46	,,
Totals, .	105	1,567	40	169	49	98	194	1,834	.	9	8	47	2	483	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.		£					
.	From Jan. to May, and from Sept. to Dec.	1 mile to 4 miles off.	358	Cod, haddocks and crabs.	Good.	.	Below average.	The crab fishing was the most important. There is no landing pier or shelter for boats at the creek.
July and Aug.	,,	1 mile to 6 miles off.	1,248	,,	,,	.	,,	All the herrings caught by Catterline fishermen in summer were landed chiefly at Stonehaven. There is a small landing pier at the creek, but little or no shelter for boats.
,,	,,	,,	190	,,	,,	1	,,	All the herrings caught by Crawton fishermen were landed at Stonehaven. There is no landing pier or shelter for boats at the creek.
,,	From Jan. to June, and from Sept. to Dec.	1 mile to 20 miles, 30 to 70, and 80 to 160 miles off.	18,889	Herrings, cod, ling, haddocks, whiting and crabs.	Good, except haddocks, which were of mixed quality.	14	,,	The prosecution and development of the fishing industry is a good deal hindered by the limited and unsatisfactory harbour accommodation.
,,	,,	,,	273	Cod, haddocks, whiting and crabs.	,,	.	Much below average.	All the herrings, and the great bulk of the white fish caught by the Cowie fishermen were landed chiefly at Stonehaven. There is a small landing pier, but little or no shelter for boats at the creek.
,,	,,	,,	1,513	Haddocks, whiting and crabs.	Fairly good.	1	Below average.	All the herrings, and all the white fish caught in April, May and June by the Skateraw fishermen were landed at Stonehaven and Aberdeen. There is a landing pier at the creek, but no shelter for boats.
			22,471			16		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Aberdeen District.															
Downies (Kincardine) .	5	60	1	5	6	12	12	77	.	.	.	1	.	25	Net and line.
Portlethen . .	22	286	4	24	13	26	39	336	1	2	.	.	.	85	,,
Findon . . .	.	.	.	.	1	2	1	2	.	.	.	.	.	4	Line.
Cove . . .	7	91	7	42	10	20	24	153	1	.	.	61	2	55	Net and line.
Aberdeen (Aberdeenshire) . . .	120	1,920	67	402	5	10	192	2,332	15	122	.	.	5	628 294	Net, line and trawl.
Totals, .	154	2,357	79	473	35	70	268	2,900	17	124	.	62	7	1,091	
Peterhead District.															
Newburgh (Aberdeenshire) . . .	.	.	3	6	3	6	6	12	1	4	.	.	.	17	Line.
Carry forward, .	.	.	3	6	3	6	6	12	1	4	.	.	.	17	

Note.—In addition to the above, there were 131 trawlers which landed fish in 1893 at Aberdeen, 124 of which were propelled catches occasionally.

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.		£					
.	All the year.	From 2 to 50 miles.	1,109	Haddock and whiting.	Unusual quantity of small haddocks.	.	Fair.	The line fishing boats at all the stations or creeks of the district landed an unusually large proportion of very small-sized haddocks, from the month of July to the end of the year.
.	,,	,,	2,623	,,	,,	.	,,	
.	,,	From 1 to 3 miles.	97	,,	,,	.	,,	
.	,,	From 2 to 50 miles.	1,574	,,	,,	.	,,	
9 weeks.	,,	The herring grounds lay chiefly offshore from 12 to 45 miles. Small line boats 2 to 50 miles off. Great line boats 2 to 30 miles along the coast during the winter season, and from 60 to 220 miles E. and E.N.E. during the rest of the year. First class trawlers from 100 to 230 miles fishing E. (Fisher Bank, etc.), Pentland Firth, Orkney Islands, West Coast, and Iceland. Second class trawlers from 5 to 80 miles along the coast, north and south.	324,695	Herring, cod, ling, saithe, haddock, whiting, turbot, halibut, lemon soles, plaice, witches, and skate.	Apart from small haddocks caught by line, "spawny" haddocks landed by trawlers and Iceland fish generally good.	41	Comparatively good, apart from the catch of small haddocks by lines.	
			330,098			41		
.	All the year.	Along the coast within 10 miles.	646	Haddocks and whiting.	Good.	.	Increase.	The haddock fishing may be said to be confined to 6 months of the year, and the great line fishing to 3 or 4 months, but at most of the creeks a few boats prosecute the line fishing all the year round. During the herring fishing season, these are manned by old men and young lads.
			646			.		

by steam and 7 by sail, and of these 79 steam trawlers fished regularly, and 45 steamers and 7 sailing vessels landed their

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward,	.	.	3	6	3	6	6	12	1	4	.	.	.	17	
Peterhead District—continued.															
Collieston (Aberdeenshire),	14	280	28	140	1	2	43	422	1	114	.	.	.	84	Line.
Old Castle ,,	3	66	11	44	.	.	14	110	.	.	1	13	.	28	,,
Whinnyfold ,,	8	152	10	30	4	8	22	190	.	.	.	10	.	37	,,
Port Erroll ,,	27	405	8	32	7	14	42	451	.	.	.	76	.	68	,,
Bullers of Buchan ,,	1	18	2	8	3	6	6	32	.	.	.	3	.	6	,,
Boddam ,,	88	1,496	14	70	3	6	105	1,572	.	.	6	174	.	199	Line and net.
Burnhaven ,,	3	66	5	20	9	18	17	104	.	7	.	.	.	12	Line.
Peterhead ,,	142	2,982	37	185	34	68	213	3,235	15	359	.	.	.	416	Line and Net.
Buchanhaven ,,	61	1,098	11	55	17	34	89	1,187	4	4	.	.	.	184	Line.
Totals,	347	6,563	129	590	81	162	557	7,315	21	488	7	276	.	1,051	
Fraserburgh District.															
St Combs (Aberdeenshire),	32	800	54	270	6	18	92	1,088	.	125	17	.	.	128	Small and hand lines and crab fishing.
Charlestown ,,	3	75	13	65	.	.	16	140	1	1	.	.	.	29	,,
Inverallochy ,,	35	875	60	300	3	9	98	1,184	.	.	22	68	.	188	,,
Cairnbulg ,,	24	600	42	210	1	3	67	813	.	102	7	.	.	116	,,
Fraserburgh ,,	98	2,450	78	390	8	24	184	2,864	10	718	.	.	.	420	Drift nets, great, small, and hand lines, and crab fishing.
Carry forward,	192	4,800	247	1,235	18	54	457	6,089	11	946	46	68	.	881	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.							
			£ 646			.		
.	8 months.	Along the coast within 10 miles.	1,699	Haddocks, whiting and flounders.	Good.	.	Decrease.	The great increase in tonnage, as compared with the slight increase in the number of boats, is due to the fact that small boats have been replaced by large ones.
.	,,	,,	491	,,	,,	.	,,	
.	,,	,,	724	Haddocks, cod, and whiting.	,	1	,,	
.	,,	,,	1,101	Haddocks.	,,	1	Increase.	
.	,,	,,	51	,,	,,	.	Decrease.	
2 to 3 months.	,,	Along the coast within 40 miles.	5,322	Herring and haddocks.	,,	5	,,	
,,	All the year.	Within a few miles of coast.	43	Cod and haddocks.	,,	.	,,	
3 to 4 months.	6 to 8 months.	From 160 miles, N.E. E. and S.E. of land.	151,170	Herring, cod, and haddocks.	,,	79	Increase.	
.	,,	Along the coast within a few miles.	150	Cod and haddocks.	,,	.	Decrease.	
			161,397			86		
.	End of Sept. to 1st June.	Handline fishing ground between Rattray Head and Cairnbulg Point in an offing of 4 miles.	979	Cod, codlings and saithe.	Good.	.	Little below 1892, but favourable compared with some previous years.	The fishermen working haddock lines from St Combs, Inverallochy and Cairnbulg operate on the same ground as those from Fraserburgh. Crews fishing herrings from Pittulie and Rosehearty usually work along with the Fraserburgh fleet.
.	,,	,,		,,	Good.	.		
.	,,	,,	890	,,	,,	.		
.	,,	,,		,,	,,	.		
23rd May to 15th Sept.	1st Oct. to 31st May.	Haddocks 12 to 15 miles N.N.E. of Kinnaird Head, and also 18 to 25 miles E.N.E., cod and ling 40 to 60 miles N.E., herring 27 to 55 miles N.N.E. of Kinnaird Head, and also 12 to 15 miles off Troup-head, also in vicinity of Orkney, Fair Isle, and Bergen Bank.	176,351	Herring, cod, ling, saithe, skate, halibut and haddock.	Excellent, except on two or three occasions, when calm weather was experienced.	74	Herring fishing best on record, haddock declined slightly, but cod and ling fishing improved.	
			178,220			74		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	192	4,800	247	1,235	18	54	457	6,089	11	946	46	68	.	881	
Fraserburgh District—continued.															
Pittulie (Aberdeenshire),	17	425	15	75	5	15	37	515	.	67	4	.	.	78	Drift nets and small lines.
Rosehearty ,,	42	1,050	34	170	.	.	76	1,220	.	126	12	.	1	180	Do., and crab fishing.
Pennan ,,	9	225	26	130	.	.	35	355	.	67	1	.	.	56	Small lines and crab fishing.
Totals, .	260	6,500	322	1,610	23	69	605	8,179	11	1,206	63	68	1	1,195	
Banff District.															
Crovie (Banffshire),	17	374	20	100	16	48	53	522	.	40	1	.	.	118	Great and small lines and crab and lobster creels.
Gardenstown ,,	46	1,012	24	120	26	78	96	1,210	.	68	.	.	.	214	Great and small lines and herring nets.
Macduff ,,	49	1,078	28	140	34	102	111	1,320	1	84	.	.	.	278	,,
Banff	36	792	4	20	10	30	50	842	4	114	.	.	.	152	,,
Whitehills .	26	572	38	190	22	66	86	828	.	.	7	50	.	232	Great and small lines, and crab and lobster creels.
Portsoy ,,	17	374	10	50	13	39	40	463	.	.	9	170	.	132	Great and small lines and herring nets.
Sandend ,,	13	286	16	80	9	27	38	393	.	13	1	.	.	80	Great and small lines, and crab and lobster creels.
Totals, .	204	4,488	140	700	130	390	474	5,578	5	319	18	220	.	1,206	

Note.—In addition to the above, there was 1 trawler belonging to Fraserburgh.

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herrings.	White Fish.		£					
			178,220			74		
From 4th July to end of August.	From end of Sept. to June.	Haddock fishing ground from 2 to 8 miles from Sandhaven harbour, between N.W. and N.E.	4,880	Herring and haddock	Good.	2	White fishing decreased slightly, herring improved.	
From 4th July to 18th Aug.	From middle of Sept. to June.	Haddock fishing grounds lie from 4½ to 9 miles N.N.E. of the Rosehearty Lighthouse to a bearing N. by W. of Pennan Head.	7,977	Herring and haddock.		2	Haddock fishing disappointing. Herring good.	For the past three months, haddocks have been of a very small size.
No fishing.	From end of Sept. to June.	Haddocks are fished around Troup and Pennan Heads, at a distance of 2 to 8 miles from land.	994	Haddock and lobsters.	Good.		Below average.	
			192,071			78		
	From 1st Jan. to 1st June, and from 1st Sept. to 31st Dec.	From 8 to 20 miles N.	1,696	Haddock.	Good	1	Below average.	The methods of fishing pursued and duration of seasons are pretty much the same at all the stations in the district.
From 1st June to 31st Aug.	,,	,,	5,029	,,		4	,,	
,,	,,	From 12 to 20 miles N.	16,210	Haddock and herring.		10	,,	
,,	,,	,,	3,067	,,	,,	2	,,	
,,	,,	From 4 to 8 miles N.E.	7,614	Haddock.	,,	2	,,	
,,	,,	6 to 8 miles N.	5,390	Herring.	,,	6	,,	
,,	,,	2 to 6 miles N.	2,041	Haddock.	,,	1	,,	
			41,047			26		

district, fishing from Aberdeen, which was propelled by steam.

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
Buckie District.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Cullen (Banffshire),	77	1809½	15	75	10	30	102	1914½	8	223½	.	.	2	290	With nets and lines only.
Portknockie ,,	80	1880	15	75	26	78	121	2033	4	138	.	.	3	320	,,
Findochty ,,	76	1786	17	85	28	84	121	1955	5	262	.	.	.	276	,,
Portessie ,,	85	1997½	13	65	15	45	113	2107½	5	188½	.	.	3	350	,,
Buckie ,,	210	4935	21	105	15	45	246	5085	6	430	.	.	16	796	,,
Portgordon ,,	67	1574½	11	55	7	21	85	1650½	4	171½	.	.	2	255	,,
Totals, .	595	13982½	92	460	101	303	788	14745½	32	1413½	.	.	26	2287	
Findhorn District.															
Lossiemouth (Moray),	115	2,300	18	108	5	20	138	2,428	.	.	3	108	.	480	Nets and lines.
Hopeman ,,	52	1,040	21	126	1	4	74	1,170	.	.	2	52	.	275	,,
Burghead ,,	35	700	17	102	3	12	55	814	.	.	5	68	.	217	,,
Findhorn ,,	1	20	5	25	1	4	7	49	1	5	.	.	.	32	,,
Nairn (Nairn),	38	760	36	288	3	12	77	1,060	.	.	1	8	.	230	,,
Campbelton (Inverness),	7	126	8	48	1	4	16	178	.	.	.	.	.	53	,,
Petty ,,	1	18	.	.	.	.	1	18	.	.	3	24	.	7	Nets.
Inverness, &c. ,,	.	.	4	24	.	.	4	24	.	.	3	11	5	16	,,
Totals, .	249	4,964	109	721	14	56	372	5,741	1	5	17	271	5	1,310	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
From Jan. to end of Aug.	All the year.	Smith Bank for haddocks, and between Smith Bank and Caithness for cod, &c.	3,986	Herrings, haddock, cod and ling, halibut and skate.	Good.	4	The herring fishing was considerably under a few previous years, and the fish realised less money. The haddock fishing was a little better than in 1892, but short of former years. Cod and ling showed a decrease of nearly one-half of the returns for 1892, while the catch of halibut was nearly doubled. No turbot landed in 1893.	The weather during the summer herring season was good. The stormy weather during November and December very much interrupted the haddock fishing; and but for this there would have been a considerable increase to the total catch. Had the immense number of small haddocks landed been of the ordinary size, the fishing would have been the largest on record.
,,	,,	From Helmsdale to about 8 miles off Portsoy, and from 2 to 25 miles N.E. off Buckie for herrings.	6,835	,,	,,	3		
,,	,,		4,349	,,	,,	4		
,,	,,	A considerable quantity of haddocks have been got recently a few miles inshore of Smith Bank.	94	,,	,,	.		
,,	,,		27,183	,,	,,	13		
,,	,,		1,653	,,	,,	1		
			44,100			30		
8 weeks.	All the year.	4 to 15 miles off.	3,000	Haddock.	Inferior.	1	Decrease.	There is a decrease in the quantity and value of fish landed at all the stations as compared with last year, except Inverness, where there is a large increase in sprats.
,,	,,	,,	5,612	Herrings and haddock.	Fair.	2	,,	
,,	,,	2 to 25 miles off.	8,926	,,	,,	8	,,	
No fishing.	,,	4 to 5 miles off.	643	Haddock.	Inferior.	.	,,	
,,	,,	2 to 20 miles off.	4,605	,,	,,	.	,,	
,,	,,	2 to 6 miles off.	809	,,	,,	.	,,	
,,	,,	No fishing.	.	.	.	.	.	
3 months.	,,	Beauly Firth.	7,031	Sprat.	Fair.	.	Increase.	
			30,626			11		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
Cromarty District.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Craigton and Kilmuir (Ross)	.	.	6	30	.	.	6	30	.	.	.	.	.	30	Nets.
Avoch ,,	38	608	39	234	5	10	82	852	.	.	2	12	1	224	Nets and lines.
Fortrose and Rosemarkie ,,	.	.	.	.	4	8	4	8	.	.	.	.	.	16	Lines.
Cromarty ,,	16	288	23	92	25	75	64	455	.	.	2	25	.	171	,,
Nigg ,,	.	.	1	4	8	16	9	20	.	.	1	2	.	30	,,
Invergordon, &c. ,,	.	.	.	.	6	12	6	12	.	.	.	.	.	24	,,
Balintrad ,,	.	.	.	.	2	4	2	4	.	.	.	.	.	8	,,
Shandwick ,,	6	84	6	24	1	2	13	110	.	.	.	.	.	40	Nets and lines.
Balintore ,,	15	210	8	32	2	4	25	246	.	.	.	.	1	75	,,
Hilton ,,	11	154	8	32	6	12	25	198	.	.	.	.	.	80	,,
Rockfield ,,	7	91	5	15	3	9	15	115	.	.	1	13	.	61	,,
Portmahomack ,,	13	195	6	24	2	6	21	225	.	.	.	.	.	124	,,
Inver ,,	14	196	8	32	4	12	26	240	1	4	.	.	.	65	Lines.
Totals, .	120	1,826	110	519	68	170	298	2,515	1	4	6	52	2	948	
Helmsdale District.															
Embo (Sutherland)	30	510	14	56	3	6	47	572	2	34	.	.	.	98	Chiefly small line fishing.
Golspie ,,	17	272	13	65	2	4	32	341	3	37	.	.	1	65	,,
Brora ,,	15	270	9	45	3	6	27	321	.	.	1	2	.	62	,,
Portgower ,,	6	90	4	20	2	4	12	114	.	.	.	.	.	24	,,
Helmsdale ,,	18	306	12	60	12	36	42	402	2	12	.	.	1	68	Net and line fishing.
Navidale ,,	.	.	.	.	2	4	2	4	.	.	.	.	.	8	Small and hand-line fishing.
Carry forward, .	86	1,448	52	246	24	60	162	1,754	7	83	1	2	2	325	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
.	All the year.	Inverness Firth.						
July to December.	,,	,,	214	Haddock.	Fairly good.	.	Above average.	
.	,,	,,						
.	,,	6 to 10 miles E.S.E. to N.E. of Cromarty.						
.	,,	,,	4,131	Haddock, cod and flounder.	Fairly good, but large proportion of small haddocks.	.	About £400 under last year.	This decrease is largely owing to the large proportion of small and unmarketable haddocks.
.	,,	Cromarty Firth.						
.	,,	,,						
.	,,	4 to 8 miles off Balintore.						
July to September.	,,		3,260	Herring and haddock.	Good.	1	Value more than doubled.	Accounted for by herring curing for the first time at Balintore.
.	,,	,,						
July to September.	,,	6 to 10 miles off Tarbat Ness.	3,059	,,	Good, but a great many small haddocks.	2	Very much under 1892.	This arises chiefly through herring fishing being much short of the preceding year.
.	,,	,,		,,	,,	.		
.	,,	,,	277	Haddock and cod.	Fair.	.	Slight increase.	
			10,941			3		
From Jan. to April, and from July to Sept.	The year round.	Along the coast from 3 to 5 miles off. Best flounder fishing ground close along the shore.	427	Haddock.	Good.	.	Slightly better; more flounders and haddocks got.	All the first-class boats fish at Helmsdale during the summer herring fishing. Only small boats fish at Embo.
,,	,,	,,	[illegible]	,,	,,	.	,,	All but 3 of the first-class boats fish during the summer herring fishing at Helmsdale.
,,	,,	,,	[illegible]	,,	,,	.	Average.	All but 2 of the first-class boats fish during the summer herring fishing at Helmsdale.
,,	,,	,,	186	,,	,,	.	,,	All the first-class boats fish at Helmsdale.
,,	,,	Most herrings were got at from 3 to 5 miles south of Helmsdale, other fish mostly within 5 miles of the shore.	12,900	Herring.	,,	10	Herring fishing better, cod much worse.	Helmsdale boats all fish at home.
,,	,,	2 to 3 miles off.		Codling.	,,	.	Average.	Fish mostly consumed fresh at home.
			£15,040			10		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward,	86	1,448	52	246	24	60	162	1,754	7	83	1	2	2	325	
Helmsdale District—continued.															
Berridale (Caithness)	.	.	.	.	4	8	4	8	.	.	.	.	.	16	Small and hand-line fishing.
Dunbeath ,,	21	378	1	6	17	34	39	418	.	.	1	18	.	88	Net and line fishing.
Totals, . .	107	1,826	53	252	45	102	205	2,180	7	83	2	20	2	429	
Lybster District.															
Latheronwheel (Caithness)	8	128	6	30	9	18	23	176	.	9	.	.	1	56	Nets and lines.
Forse ,,	11	220	4	32	4	8	19	260	2	40	.	.	.	66	,,
Lybster ,,	63	1,260	15	60	8	16	86	1,336	.	.	.	128	3	290	,,
Clyth ,,	8	144	6	30	7	14	21	188	.	.	.	.	.	84	,,
Totals, . .	90	1,752	31	152	28	56	149	1,960	2	49	.	128	4	496	
Wick District.															
Whaligoe (Caithness)	6	108	2	12	6	18	14	138	.	.	1	3	.	50	Nets and lines.
Sarclet ,,	9	162	1	6	4	12	14	180	.	.	1	4	.	58	,,
Wick and Pulteney ,,	176	3,520	9	72	44	132	229	3,724	.	.	15	247	3	804	,,
Boathaven to Elzie ,,	8	160	3	24	8	24	19	208	.	.	.	.	.	43	,,
Staxigoe ,,	3	60	5	40	7	21	15	121	.	.	.	.	.	49	,,
Ackergill ,,	4	72	4	24	5	15	13	111	.	.	.	.	.	28	,,
Keiss ,,	19	342	2	12	23	69	44	423	.	.	3	39	.	130	,,
Nybster and Auckingill ,,	4	72	1	6	11	33	16	111	.	15	.	.	.	44	,,
Freswick ,,	2	36	.	.	13	39	15	75	.	.	2	21	.	56	,,
Carry forward,	231	4,532	27	196	121	363	379	5,091	.	15	22	314	3	1,262	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks
Herring.	White Fish.							
			£ 15,140			10		
From Jan. to April, and from July to Sept.	The year round.	2 to 3 miles off.	2,379	Codlings.	Good.	.	Average	Fish mostly consumed fresh at home.
,,	,,	Along the coast from 2 to 8 miles off.		Herring.	Good, but more spent than last year.	3	Herring fishing much better, cod worse than for many years.	Dunbeath boats all fish at home.
			17,417			13		
18th July to 6th Sept.	1st Oct. to 30th Mar.	From 2 to 12 miles off.	409	Herrings, cod, and haddock.	Good.	.	Decrease.	There were no herrings cured at Latheronwheel this season, and Lybster is now the only station in the district where curing is carried on.
,,	,,	,,		,,	,,	.	.	
,,	,,	,,	5,497	,,	,,	13	Increase.	
,,	,,	,,	313	,,	,,	.	Decrease.	
			6,219			13		
1st July to 10th Sept.	All year round.	1 to 10 miles E.	289	Cod and haddock.	Generally good.	.	The cod, ling and haddock fishings fell short of the returns for some previous years, but the herring fishing was fully up to the average.	
,,	,,	,,		,,	,,	.		
,,	,,	2 to 50 miles E.	44,658	Herring, cod, ling, haddock, &c.	,,	61		
,,	,,	,,	1,520	,,	,,	.		
,,	,,	,,		,,	,,	.		
,,	,,	2 to 30 miles E.	633	Cod, ling, and haddock.	,,	.		
,,	,,	,,	1,058	Herring, cod, ling, haddock, &c.	,,	1		
,,	,,	,,		Cod and haddock.	,,	.		
,,	,,	,,		,,	,,	.		
			£48,158			62		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	231	4,532	27	196	121	363	379	5,091	.	15	22	314	3	1,262	
Wick District—continued.															
Duncansbay and Huna (Caithness)	5	90	.	.	26	78	31	168	.	.	.	15	.	72	Nets and lines.
Stroma ,,	11	198	2	16	44	132	57	346	.	.	.	11	.	124	,,
Gills and Mey ,,	4	72	.	.	18	54	22	126	.	.	3	24	.	69	,,
Scarfskerry and Ham ,,	.	.	1	6	14	42	15	48	2	.	.	6	.	56	Lines.
Brough and Dunnet ,,	.	.	.	.	14	42	14	42	.	.	2	6	.	44	,,
Castlehill and Murkle ,,	.	.	.	.	7	21	7	21	.	.	1	3	.	26	,,
Thurso and Scrabster ,,	13	234	12	96	12	36	37	366	5	70	.	.	.	88	Nets and lines.
Crosskirk and Brims ,,	.	.	1	6	7	21	8	27	.	.	1	6	.	30	Lines.
Sandside ,,	.	.	1	6	5	15	6	21	.	.	4	15	.	26	,,
Portskerra (Sutherland)	8	144	6	48	7	21	21	213	1	23	.	.	.	90	Nets and lines.
Strathypoint ,,	1	16	1	6	5	15	7	37	.	.	2	16	.	30	,,
Armadale ,,	2	32	2	12	5	15	9	59	.	.	.	11	.	32	,,
Kirtomy and Farr ,,	5	100	2	12	7	21	14	133	1	9	.	.	.	71	,,
Island Roan, Skerray, &c. ,,	4	80	1	6	16	48	21	134	.	.	4	26	.	105	,,
Coldibacky and Scullomy ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	17	Lines.
Talmine and Portvasgo ,,	3	60	3	18	16	48	22	126	1	9	.	.	.	78	Nets and lines.
Erriboll, Rispond, Smoo, &c. ,,	.	.	.	.	30	90	30	90	.	.	2	6	.	90	Lines.
Totals, .	287	5,558	59	428	358	1,074	704	7,060	10	126	41	459	3	2,310	
Orkney District.															
South Ronaldshay .	18	288	2	10	60	120	80	418	.	.	2	32	1	200	Nets and lines.
Swona . . .	.	.	.	.	7	14	7	14	.	.	.	.	.	15	
Walls . . .	11	176	.	.	18	36	29	212	5	38	.	.	.	96	,,
Flotta . . .	3	48	.	.	16	32	19	80	2	.	.	10	.	78	,,
Fara and Cava . .	.	.	.	.	4	8	4	8	.	.	.	.	.	16	,,
Carry forward, .	32	512	2	10	105	210	139	732	7	38	2	42	1	405	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.							
			£ 48,158			62		
1st Jul. to 10th Sept.	All year round.	2 to 30 miles E.	751	Cod and saithe.	Generally good.	.		
,,	,,	1 to 2 miles N.E.	984	,,	,,	1		
No herring fishing.	,,	,,	1,149	,,	,,	.		
,,	,,	,,		,,	,,	.		
,,	,,	,,		,,	,,	.		
,,	,,	1 to 5 miles N.E.	627	,,	,,	.		
1st May to 1st Aug.	,,	2 to 30 miles N.W.	39,074	Herring, cod, ling, haddock, &c.	,,	59	(See preceding page.)	
No herring fishing.	,,	2 to 6 miles N.W.	349	Cod, ling, and haddock.	,,	.		
,,	,,	,,	442	,,	,,	.		
10th May to 1st July.	,,	2 to 10 miles N.W.	1,418	Herring, cod, and ling.	,,	1		
,,	,,	2 to 6 miles N.W.		Cod, ling, &c.	,,	.		
,,	,,	,,		,,	,,	.		
,,	,,	2 to 7 miles N.W.	246	,,	,,	.		
,,	,,	2 to 35 miles N.W.	608	,,	,,	.		
No herring fishing.	,,	2 to 4 miles N.W.		Cod and flounder.	,,	.		
10th May to 1st July.	,,	2 to 8 miles N.W.	418	,,	,,	.		
No herring fishing.	,,	2 to 6 miles N.W.	1,891	,,	,,	.		
			96,115			123		
15th July to 6th Sept.	Jan. to Dec.	Off Copinshay 5 to 10 miles.	1,227	Herring.	Good.	■	(See next page.)	Herring boats are becoming less in number, and the fishing has dwindled considerably of late years at South Ronaldshay.
.	,,	Pentland Firth.		Cod.	,,	.		
.	,,	Longhope and Pentland.	146	,,	,,	.		The herring boats fish at other stations. The other boats prosecute the lobster fishing chiefly, returns of which are furnished under Stromness and Kirkwall.
.	,,	,,		,,	,,	1		
.	,,	Scapa Flow.		Haddock.	,,	.		
			£1,373			3		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Method of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	32	512	2	10	105	210	139	732	7	38	2	42	1	405	
Orkney District—continued.															
Hoy and Gramesay .	3	48	.	.	24	48	27	96	15	30	.	.	.	60	Nets and lines.
Stromness . .	5	80	4	20	16	32	25	132	3	.	.	8	1	59	,,
Orphir and Scapa .	.	.	2	10	10	20	12	30	.	.	1	2	.	36	,,
Holm . . .	9	144	2	10	12	24	23	178	.	.	3	6	1	67	,,
Burray . . .	20	320	.	.	16	32	36	352	.	.	1	2	1	110	,,
Deerness . .	9	144	.	.	12	24	21	168	4	36	.	.	.	60	,,
Tankerness . .	.	.	.	.	6	12	6	12	.	.	1	16	.	18	,,
Kirkwall . .	4	64	5	25	15	30	24	119	.	.	3	28	.	80	,,
Evie and Birsay .	2	32	.	.	16	32	18	64	.	.	1	16	.	60	,,
Rousay . . .	2	32	.	.	14	28	16	60	.	.	1	16	.	39	,,
Egilshay and Viera .	.	.	.	.	5	10	5	10	.	.	.	.	.	15	,,
Shapinshay . .	3	48	.	.	16	32	19	80	.	.	1	16	1	70	,,
Stronsay . .	11	176	.	.	28	56	39	232	4	8	.	.	.	90	,,
Eday and Fara (North)	4	64	1	8	30	60	35	132	3	.	.	8	.	79	,,
Westray and Papa .	8	128	24	192	143	286	175	606	5	22	.	.	1	330	,,
Sanday . . .	2	32	.	.	14	28	16	60	.	.	1	16	.	55	,,
North Ronaldshay .	9	135	2	10	27	54	38	199	4	14	.	.	.	80	,,
Totals, .	123	1,959	42	285	509	1,018	674	3,262	45	148	15	176	6	1,713	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
			1,373			3		
.	Jan. to Dec.	Scapa Flow chiefly.	77	Cod and haddock.	Good.	.		All lobsters caught, and majority of fish, returned under Stromness.
15th May to 10th July.	,,	Off Hoy 10 miles.	21,260	Herring.	,,	30		The most important herring station in Orkney.
.	,,	Scapa Flow.	400	Haddocks.	,,	1		
15th July to 6th Sept.	,,	Off Copinshay 5 miles.	1,463	Herring.	,,	3		Entirely a herring station, but on the decline.
,,	,,	,,	1,091	,,	,,	2		,,
.	,,	Deersound.	78	Lobsters.	,,	.		Herring boats fish at other stations. Returns of lobsters caught at these places are entered under Kirkwall.
	,,	,,	} 7,899 {	,,	,,	.		,,
.	,,	Stronsay Sound chiefly.		Cod and haddocks.	,,	4		Lobsters and other shell-fish from nearly all the "North Isles" are sold at Kirkwall and returned under Kirkwall.
.	,,	Inshore.	84	,,	,,	.		Herring boats fish at other stations during the herring fishing season only.
.	,,	,,	} 94 {	,,	,,	.		,,
.	,,	,,		,,	,,	1		,,
.	,,	Stronsay Sound.	1,421	,,	,,	1		Herring boats fish at other stations.
15th July to 6th Sept.	,,	10 miles off the island.	4,833	Herring.	,,	4		Herring station chiefly.
.	,,	North Sound.	522	Cod.	,,	1		Herring boats fish at other stations.
15th May to 10th July.	,,	,,	4,625	,,	,,	7		Most important cod and ling station in Orkney.
.	Lobsters.	Inshore.	76	Lobsters.	,,	.		Herring boats fish at other stations.
.	,,	,,	271	Cod.	,,	.		,,
			45,567			57		

The result of the fishing of 1893, as compared with previous years, is the best since 1885, so far as the quantity of herring landed is concerned. The cod and ling fishing of 1893, was, however, the poorest, as to quantity landed, since 1884.

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Shetland District.															
Dunrossness (Dunrossness and Fair Isle)	4	60	12	24	28	28	44	112	.	.	.	.	.	175	Nets, hand, and long lines.
Queendale ,,	.	.	.	.	9	9	9	9	.	.	.	.	.	27	,,
Spiggie ,,	2	30	.	.	6	6	8	36	.	.	.	.	1	18	,,
Maywick ,,	.	.	.	.	8	8	8	8	.	.	.	.	.	28	,,
Fair Isle ,,	.	.	.	.	9	9	9	9	.	.	.	.	.	36	Hand lines.
Levenwick ,,	6	90	6	12	4	4	16	106	.	.	.	.	.	78	Nets, hand, and long lines.
Hoswick ,,	8	161	5	10	8	8	21	179	.	.	.	.	2	95	,,
Sandsair ,,	8	120	3	6	7	7	18	133	.	.	.	.	.	78	,,
Althsvoe ,,	12	180	4	8	9	9	25	197	.	.	.	.	2	104	,,
Bressay ,,	6	90	.	.	6	6	12	96	.	.	.	.	.	48	,,
Lerwick ,,	70	1,347	6	12	21	21	97	1,380	.	.	.	.	6	533	,,
Nesting (Whalsay and Skerries)	6	96	.	.	4	4	10	100	.	.	.	.	.	48	,,
Whalsay ,,	21	336	1	2	19	19	41	357	.	.	.	.	.	148	,,
Skerries ,,	2	32	2	4	4	4	8	40	.	.	.	.	1	32	,,
Vidlin ,,	2	32	3	6	.	.	5	38	.	.	.	.	.	38	,,
Burravoe (Yell and Fetlar)	.	.	.	.	6	6	6	6	.	.	.	.	.	15	,,
Gossaburgh ,,	.	.	.	.	4	4	4	4	.	.	.	.	.	12	,,
Midyell ,,	10	160	.	.	12	12	22	172	.	.	.	.	6	58	,,
Gutcher ,,	3	48	2	4	6	6	11	58	.	.	.	.	.	24	,,
Cullivoe ,,	3	48	5	10	7	7	15	65	.	.	.	.	.	41	,,
Fetlar ,,	.	.	1	2	6	6	7	8	.	.	.	.	.	14	,,
West Sandwick ,,	4	64	.	.	5	5	9	69	.	.	.	.	.	24	,,
Uyasound (Uyasound)	12	192	1	2	5	5	18	199	.	.	.	.	.	40	,,
Mueness ,,	.	.	.	.	3	3	3	3	.	.	.	.	.	6	,,
Westing ,,	.	.	.	.	10	10	10	10	.	.	.	.	4	28	,,
Suaravoe ,,	.	.	.	.	5	5	5	5	.	.	.	.	.	5	,,
Ramnigoe ,,	.	.	.	.	2	2	2	2	.	.	.	.	.	5	,,
Carry forward,	179	3,086	51	102	213	213	443	3,401	.	.	.	.	22	1,758	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
Augnst.	May to Sept.	1 to 30 miles off.		Saithe, cod, and ling.	Good.	2	In-crease.	With the exception of Lerwick, where the August herring fishing was a failure, all other divisions of the district show a very considerable increase in the quantity and value of fish landed, compared with the preceding year.
,,	,,	,,	2,377	,,	,,	1	,,	
,,	,,	,,		,,	,,	1	,,	
,,	,,	,,		,,	,,	1	,,	
,,	,,	,,		,,	,,	1	,,	
July, Aug., and Sept.	April to Sept.	1 to 50 miles S.E.	2,483	Herrings, cod, and ling.	,,	1	,,	
,,	,,	,,		,,	,,	2	,,	
,,	,,	,,	932	,,	,,	1	,,	
,,	,,	,,		,,	,,	1	,,	
,,	Jan. to Dec.	,,	8,103	Herrings, cod, and haddocks.	,,	3	Below average.	
,,	,,	,,		,,	,,	17	,,	
.	,,	,,		,,	,,	.	In-crease.	Under the new grouping of the creeks it is difficult to show the individual increases or decreases in the number and tonnage of boats; the net decrease in the number and tonnage of *boats* compared with 1892 is shown at the end of the return.
July, Aug., and Sept.	,,	,,	3,103	,,	,,	1	,,	
,,	Winter and spring.	,,		,,	,,	1	,,	
.	,,	,,		,,	,,	.	,,	
.	,,	,,		,,	,,	1	Large in-crease.	
.	Jan. to Dec.	,,		,,	,,	.	,,	
.	Winter months.	,,		,,	,,	4	,,	
.	,,	,,	9,811	,,	,,	1	,,	
June.	Jan. to Dec.	,,		,,	,,	8	,,	
.	April to Sept.	,,		,,	,,	1	,,	
June.	Winter months.	,,		,,	,,	1	,,	
June to Sept.	Jan. to Dec.	East and West side, 1 to 40 miles off.		,,	Fair.	.	Above average.	
.	Winter months.	,,		,,	,,	.	,,	
.	,,	,,	1,960	,,	,,	.	,,	
.	,,	,,		,,	,,	.	,,	
.	,,	,,		,,	,,	.	,,	It may be mentioned that this return includes 21 fishing *vessels* of 1130 tons, which were not included in the creek return in former years, only boats being given previously.
			28,769			51		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward	179	3,086	51	102	213	213	443	3,401	.	.	.	.	22	1,758	
Shetland District—continued.															
Baltasound (Baltasound)	7	112	.	.	4	4	11	116	.	.	.	.	.	54	Net, hand, and long lines.
Colvidaal ,,	.	.	.	.	3	3	3	3	.	.	.	.	.	12	Hand and long lines.
Haroldswick ,,	1	16	2	4	8	8	11	28	.	.	.	.	.	30	,,
Norwick ,,	1	16	2	4	5	5	8	25	.	.	.	.	.	32	,,
Burrafirth ,,	.	.	4	8	8	8	12	16	.	.	.	.	.	34	,,
Fethaland (North Roe and Yell Sound)	.	.	12	24	13	13	25	37	.	.	.	.	.	72	,,
Ollaberry ,,	.	.	.	.	11	11	11	11	.	.	.	.	.	40	,,
Dalesvoe ,,	6	96	.	.	3	3	9	99	.	.	.	.	2	36	,,
Mossbank ,,	4	64	.	.	8	8	12	72	.	.	.	.	.	24	,,
Sandvoe ,,	.	.	2	4	.	.	2	4	.	.	.	.	.	12	,,
Ronasvoe (Ronasvoe and Hillswick)	.	.	5	10	5	5	10	15	.	.	.	.	.	36	Nets, hand, and long lines.
Stennis ,,	.	.	10	20	3	3	13	23	.	.	.	.	.	72	,,
Hillswick ,,	4	64	.	.	25	25	29	89	.	.	.	.	.	40	,,
Papa and Voe (Walls, Sandness, and Foula)	8	214	1	2	8	8	17	224	.	.	.	.	.	70	,,
Foula ,,	2	30	5	10	.	.	7	40	.	.	.	.	.	40	Hand and long lines.
Sandness ,,	3	45	2	4	9	9	14	58	.	.	.	.	.	30	,,
Vaila Sound ,,	9	135	.	.	13	13	22	148	.	.	.	.	4	58	Nets, hand, and long lines.
Skeld ,,	4	60	.	.	5	5	9	65	.	.	.	.	.	24	Hand and long lines.
Reawick ,,	6	90	.	.	3	3	9	93	.	.	.	.	.	30	Nets, hand, and long lines.
Sand ,,	4	60	.	.	6	6	10	66	.	.	.	.	.	30	,,
Whiteness ,,	6	90	.	.	8	8	14	98	.	.	.	.	.	45	,,
Burwick (Scalloway and Isles)	2	30	.	.	3	3	5	33	.	.	.	.	.	12	,,
Scalloway ,,	19	668	.	.	38	38	57	706	.	.	.	.	.	146	,,
Oxna Isle ,,	2	30	.	.	4	4	6	34	.	.	.	.	.	12	,,
Havera Isle ,,	.	.	.	.	6	6	6	6	.	.	.	.	2	14	,,
Burra Isle ,,	13	195	.	.	12	12	25	207	.	.	.	.	.	74	,,
Trondera Isle ,,	4	60	.	.	4	4	8	64	.	.	.	.	.	22	,,
Totals, . .	284	5,161	96	192	428	428	808	5,781	.	.	28	222	30	2,859	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.							
			£ 28,769			51		
June to Sept.	Jan. to Dec.	1 to 40 miles off.		Herrings, cod, ling, and haddocks.	Good.	17	Increase.	Herring and cod and ling fishing prosecuted chiefly by East Coast crews.
"	Winter months.	"		Cod, ling, and haddocks.	"	.	"	
"	Jan. to Dec.	"	10,775	"	"	1	"	
"	"	"		"	"	1	"	
"	April to Sept.	"		"	"	1	"	
"	"	1 to 30 miles off.		"	"	3	"	
.	Winter months.	1 to 6 miles off.		"	"	2	"	
"	"	"	6,177	"	"	.	"	
"	"	"		"	"	1	"	
"	April to Sept.	1 to 30 miles off.		"	"	1	"	
"	Jan. to Dec.	"		Herrings, cod, ling, and haddocks.	"	5	Above average.	
"	May to Sept.	"	7,018	Cod and ling.	"	3	"	
June and July.	Jan. to Dec.	"		Herrings, cod, ling, and haddocks.	"	1	"	
"	"	"		"	"	2	"	Herrings were found in large numbers at Voe in July and August, 6 to 8 miles from the open sea.
"	Summer months.	"		Cod and ling.	"	1	"	
"	Jan. to Dec.	"		Cod, ling, and haddocks.	"	.	"	
June and July.	Apr. to Oct.	1 to 40 miles off.	13,805	Herrings, cod, and haddocks.	"	3	"	
"	"	"		Cod and ling.	"	1	"	
"	"	"		"	"	.	"	
"	Jan. to Dec.	"		Cod, ling, and haddocks.	"	1	"	
"	"	"		"	"	.	"	
"	"	"		"	"	.	In-	
May to Aug.	"	"		Herrings, cod, and haddocks.	"	6	"	Chief centre of the haddock fishery.
"	"	"	15,812	"	"	.	"	
"	"	"		"	"	1	"	
"	"	"		"	"	1	"	
"	"	"		"	"	.	"	
			82,356			103		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
Stornoway District.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Arivruich (Lewis, Rossshire)	.	.	.	.	6	18	6	18	.	.	.	.	.	10	Line fishing chiefly.
Lemeureva ,,	3	48	9	54	7	21	19	123	3	18	.	.	.	110	
Graver ,,	1	16	10	60	15	45	26	121	.	.	.	.	.	70	
Calbost ,,	3	48	5	30	8	24	16	102	8	38	.	.	1	45	
Marvig ,,	6	96	4	24	8	24	18	144	.	.	.	.	.	70	
Cromore ,,	3	48	8	48	6	18	17	114	.	.	.	.	.	50	
Garryvard ,,	.	.	.	.	5	15	5	15	.	.	.	.	.	18	
Kershader ,,	.	.	.	.	6	18	6	18	3	.	.	4	.	15	
Habost ,,	1	16	.	.	6	18	7	34	.	.	.	.	.	15	
Ballallan ,,	.	.	.	.	5	15	5	15	.	.	.	.	.	50	
Laxay ,,	2	32	.	.	9	27	11	59	5	2	.	.	.	25	
Keose ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	20	
Leurbost ,,	3	48	9	54	7	21	19	123	.	.	1	16	.	70	
Crossbost ,,	3	48	4	24	6	18	13	90	.	.	7	52	.	60	
Ranish ,,	6	96	5	30	10	30	21	156	3	.	.	.	.	55	
Grimshader ,,	1	16	5	30	4	12	10	58	.	.	1	16	.	40	
Stornoway ,,	.	.	2	12	15	45	17	57	.	.	1	6	.	25	Net.
Sandwick ,,	.	.	.	.	10	30	10	30	1	.	.	3	.	25	Line.
Holm ,,	.	.	.	.	4	12	4	12	.	.	3	18	.	10	,,
Melbost ,,	.	.	4	24	6	18	10	42	.	.	.	3	.	60	,,
Swordle ,,	5	100	6	36	4	12	15	148	.	.	.	.	.	71	,,
Knock ,,	7	140	9	54	4	12	20	206	.	.	.	.	.	70	
Bayble ,,	19	380	18	108	20	60	57	548	.	.	.	.	.	260	
Sheshader ,,	3	60	7	42	3	9	13	111	.	.	.	.	.	70	
Portvoller ,,	.	.	11	66	6	18	17	84	.	.	.	.	.	85	
Portnaguran ,,	5	100	12	72	6	18	23	190	.	.	.	.	.	160	
Shader ,,	3	60	6	36	3	9	12	105	.	.	.	.	.	50	
Garrabost ,,	6	120	8	48	6	18	20	186	.	8	3	.	.	110	
Stenish ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	10	,,
Tong ,,	8	160	9	54	4	12	21	226	.	.	2	40	.	111	
Vatisker ,,	.	.	5	30	7	21	12	51	.	.	1	3	.	95	
Back ,,	3	60	7	42	10	30	20	132	.	.	.	.	.	130	
Coll ,,	1	20	4	24	6	18	11	62	.	.	.	.	.	75	
Glen ,,	.	.	1	6	1	3	2	9	.	.	.	.	.	10	
Tolsta ,,	2	40	10	60	5	15	17	115	.	.	1	20	.	136	
Carry forward, .	94	1,752	178	1,068	236	708	508	3,528	23	61	20	181	1	2,286	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
"	Feb. to June.	Shiant Bank and vicinity.	2,353	Cod, ling, and saithe.	Generally inferior.	5	The value of the catch was about double that of 1892.	
Jan. to Sept.	"	10 to 20 miles S.E. off the Butt.	35,733	Herrings.	Fair.	1	Herring fishing was a failure.	
"	"	"						
"	"	"						
"	"	"						
"	Chief season Jan. to Aug.	3 miles off Tiumpan Head and entrance to Broadbay.	7,013	Ling, haddocks, and cod.	Very fair.	5		
"	Jan. to Mar., and Oct. to Dec.	Broadbay.	2,407	Haddocks	Fair.	1	Average.	
			47,506			113		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	94	1,752	178	1,068	236	708	508	3,528	23	61	20	181	1	2,286	
Stornoway District—continued.															
Skegersta (Lewis, Ross-shire)	.	.	8	72	2	6	10	78	.	3	1	.	.	48	Lines.
Port Ness ,,	1	16	36	324	6	18	43	358	.	.	1	11	.	246	
Stow ,,	.	.	9	81	.	.	9	81	.	18	.	.	.	54	
Borve ,,	.	.	5	30	2	6	7	36	.	.	1	6	.	60	
Shader, West ,,	.	.	1	6	2	6	3	12	.	.	1	6	.	30	
Barvas ,,	.	.	2	12	3	9	5	21	.	.	3	15	.	40	
Arnol ,,	1	16	3	18	3	9	7	43	.	.	.	.	.	40	,,
Bragor ,,	1	13	2	12	10	30	13	55	.	.	2	19	.	85	
Shawbost ,,	1	14	5	30	5	15	11	59	.	.	1	6	.	70	
Carloway ,,	16	224	10	70	6	18	32	312	.	.	.	.	.	180	
Tolstachuilish ,,	4	56	4	28	10	30	18	114	.	.	1	7	.	50	
Breasclete ,,	1	16	5	35	7	21	13	72	.	.	1	16	.	70	
Tobson ,,	4	56	8	56	10	30	22	142	2	28	.	.	.	60	Lines and creels.
Valsay ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	10	
Breaclete ,,	.	.	1	7	2	6	3	13	.	.	.	.	.	8	
Kirkibost ,,	2	28	3	21	3	9	8	58	.	.	.	.	.	35	
Hacklet ,,	.	.	3	21	2	6	5	27	.	.	.	.	.	20	
Crulivig ,,	.	.	.	.	3	9	3	9	.	.	.	.	.	10	Lines principally.
Eneclate ,,	.	.	.	.	3	9	3	9	.	.	1	3	.	20	
Geshader ,,	.	.	.	.	3	9	3	9	.	.	.	.	.	12	
Carrishader ,,	.	.	.	.	5	15	5	15	.	.	.	.	.	15	
Uigen ,,	.	.	3	21	.	.	3	21	.	.	.	.	.	20	
Kneep ,,	.	.	5	35	4	12	9	47	1	7	.	.	.	25	
Valtos ,,	10	140	4	28	10	30	24	198	.	.	.	.	.	120	
Airduig ,,	.	.	.	.	2	6	2	6	.	.	.	.	.	10	
Croulista ,,	4	56	4	28	5	15	13	99	.	.	.	.	.	60	
Islivig ,,	1	14	4	28	6	18	11	60	.	.	.	.	.	25	
Braenish ,,	1	14	4	28	6	18	11	60	.	.	.	.	.	35	
Scarp Island (Harris, Inverness-shire)	.	.	.	.	5	15	5	15	.	.	.	.	.	30	(See next page.)
Ardhasaig ,,	.	.	.	.	8	24	8	24	1	3	.	.	.	24	
Tarinsay ,,	.	.	2	12	6	18	8	30	.	.	.	.	.	20	
Strond ,,	1	16	6	36	25	75	32	127	.	.	.	.	.	90	
Finsbay ,,	.	.	6	36	5	15	11	51	.	.	.	.	.	50	
Quitinish ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	25	
Carry forward, .	142	2,431	321	2,143	413	1,239	876	5,813	27	120	33	270	1	3,983	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
			47,506			113		
.	Jan. to July.	10 to 15 miles N.E. of the Butt.	4,472	Ling.	Very good.	6	Catch a little above the average.	
May and June.	Jan. to Jun. and Oct. to Dec.	10 to 15 miles N.W. of Loch Roag.	15,713	Ling, haddocks, and lobsters.	Good fish generally.	8	Better ling fishing.	
.	,,	Off Gallon Head and Flannan Isles Bank.	3,222	Lobsters.	Good.	3	Decrease of white fish.	
.	Jan. to July	Flannan Isles Bank.	2,568	Ling	Good generally	9	Increase on the ling; other results same as previous years.	
(See next page.)	Jan. to Dec.	Off the coast.	(See next page.)	Lobsters.	Good.	.	Decrease of lobsters.	
			73,481			139		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward,	142	2,491	321	2,143	413	1,239	876	5,813	27	120	33	270	1	3,983	
Stornoway District—continued.															
Flodavag (Harris, Inverness-shire)	.	.	.	.	5	15	5	15	.	.	.	.	.	20	Creels &c.
Mannish ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	24	
Goecrab ,,	.	.	2	12	6	18	8	30	.	.	.	.	.	24	
Lecksted ,,	.	.	2	12	5	15	7	27	.	.	.	.	.	10	
Lachalee ,,	.	.	.	.	6	18	6	18	.	.	.	.	.	30	
Stocknish ,,	.	.	9	54	6	18	15	72	.	.	.	.	.	30	
Cluer ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	26	
Grozabay ,,	.	.	2	12	3	9	5	21	.	.	.	.	.	25	
Scadabay ,,	.	.	3	18	7	21	10	39	.	.	1	16	.	21	Nets and lines.
Hockrepool ,,	.	.	6	48	6	18	12	66	.	.	.	.	.	30	
Drinnishader ,,	1	14	3	24	5	15	9	53	.	.	.	.	.	25	
Meavig ,,	1	16	2	16	6	18	9	50	.	.	.	.	.	20	
Derriclate ,,	.	.	.	.	3	9	3	9	.	.	.	.	.	18	
Tarbert ,,	.	.	.	.	5	15	5	15	.	.	.	.	.	10	
Orrigo ,,	.	.	1	8	5	15	6	23	.	.	.	.	.	16	
Scotisay ,,	.	.	.	.	2	6	2	6	.	.	.	.	.	5	
Carrigrich ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	10	
Scalpay Island ,,	12	168	8	64	40	120	60	352	.	.	.	.	.	160	
Kyles, Scalpay ,,	1	16	4	24	8	24	13	64	.	.	.	.	.	40	
Molinginish ,,	.	.	.	.	2	6	2	6	.	.	.	.	.	8	
Rennigedle ,,	.	.	2	12	4	12	6	24	.	.	.	.	.	18	
Marig ,,	.	.	1	6	4	12	5	18	.	.	.	.	.	18	
Eleuenibe ,,	.	.	.	.	3	9	3	9	.	.	.	.	.	6	
Scaladale ,,	.	.	.	.	2	6	2	6	.	.	.	.	.	4	
Ardvourlie ,,	.	.	.	.	3	9	3	9	.	.	.	.	.	6	
Totals,	157	2,645	366	2,453	561	1,683	1,084	6,781	27	120	34	286	1	4,581	
Barra District.															
Boreray (Inverness)	.	.	.	.	5	15	5	15	.	.	1	9	.	15	Creels.
Berneray ,,	.	.	3	12	14	42	17	54	.	.	5	24	.	80	,,
Carry forward,	.	.	3	12	19	57	22	69	.	.	6	33	.	95	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
			73,481			139		
	Jan. to Dec.	Off the coast.	1,577	Lobsters	Good		Decrease of lobsters.	
June to Aug.	Jan. to Dec.	From 2 to 10 miles off Scalpay.	2,249	Herrings and lobsters.	Good firm herrings usually.	3	Decrease of herrings.	
			77,307			142		
		E. and W., ½ to 3 miles off.	649	Lobsters.	Fair.	1	(See next page.)	Duration of lobster fishing from 6 to 12 months.
		"		"	"	1		
			649			2		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease on 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward,	.	.	3	12	19	57	22	69	.	.	6	33	.	95	
Barra District—continued.															
Vallay (Inverness)	.	.	.	.	8	24	8	24	.	.	.	.	.	24	Creels.
Lochmaddy ,,	.	.	.	.	32	96	32	96	.	.	8	24	.	85	,,
Locheport ,,	.	.	.	.	25	75	25	75	.	.	2	12	.	70	,,
Græmsay Island ,,	.	.	.	.	10	30	10	30		.	.	.	.	30	,,
Heisker ,,	.	.	.	.	9	27	9	27	.	.	.	.	.	28	,,
Benbecula ,,	.	.	.	.	38	114	38	114	.	.	3	10	.	88	,,
Loch Carnan ,,	.	.	3	12	10	30	13	42	.	.	.	.	.	34	Lines and creels.
Loch Skipport ,,	.	.	6	36	7	21	13	57	.	9	1	.	.	45	,,
Loch Boisdale ,,	.	.	6	36	37	111	43	147	.	.	.	6	.	117	Nets, lines, and creels.
Eriskay ,,	.	.	12	72	10	30	22	102	.	.	.	.	.	92	,,
Bruernish ,,	5	90	4	32	11	33	20	155	2	36	.	.	.	86	,,
Ault ,,	1	15	1	8	8	24	10	47	1	15	.	.	.	48	,,
Brevig ,,	2	36	3	24	5	15	10	75	1	18	.	.	.	36	,,
Castlebay ,,	7	140	23	184	16	48	46	372	.	1	1	.	2	168	,,
Pabbay ,,	.	.	.	.	1	3	1	3	.	.	.	.	.	4	Creels.
Minglay ,,	.	.	3	24	3	9	6	33	.	.	.	.	.	31	Lines and creels.
Barrahead ,,	.	.	.	.	1	3	1	3	.	.	.	.	.	3	Hand lines.
Totals,	15	281	64	440	250	750	329	1,471	4	79	21	85	2	1,084	
Loch Broom District.															
Poulin (Sutherlandshire)	1	18	.	.	5	15	6	33	.	.	1	3	1	18	Lines, nets, and creels.
Oldshorebeg and Oldshoremore ,,	2	36	1	7	18	54	21	97	.	.	.	.	2	80	,,
Kinlochbervie ,,	3	54	1	7	8	24	12	85	.	.	.	.	.	32	,,
Badcal (Inchard) and Achriskill ,,	2	36	.	.	9	27	11	63	.	.	1	3	2	33	,,
Ardmore and Portlovorchaidh ,,	.	.	.	.	4	12	4	12	.	.	.	.	.	12	,,
Findlemore and Fanagmore ,,	1	18	.	.	4	12	5	30	.	.	2	21	3	15	,,
Tarbet and Scourie ,,	3	54	.	.	13	39	16	93	.	.	1	3	1	33	,,
Badcal (Scourie) ,,	.	.	1	7	4	12	5	19	.	.	1	3	4	20	,,
Glendhu and Unapool ,,	.	.	.	.	7	21	7	21	1	3	.	.	.	26	,,
Advar and Nedd ,,	1	15	.	.	9	27	10	42	2	6	.	.	1	20	Nets, lobster creels, and lines.
Drumbeg ,,	.	.	1	5	6	18	7	23	.	.	.	.	1	14	,,
Culkein (Drumbeg) ,,	.	.	.	.	10	30	10	30	.	.	.	.	1	16	,,
Carry forward,	13	231	4	26	97	291	114	548	3	9	6	33	16	318	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.		£					
			649			2		
.	.	N.E., ½ to 3 miles off.				.		
.	.	E., 1 to 5 miles off.				.		
.	.	,,				.		
.	.	S. E. ,,	1,185	Lobsters.	Fair.	1		
.	.	N.W., about 2 miles off.				.		
.	.	S., 1 to 3 miles off.				.		
.	6 months.	,,	509	Eels and lobsters.	Good.	1		
.	6 ,,	S.E., 3 to 7 miles off.	378	,,	,,	1		Loch Skipport and Castlebay show an increase in tonnage of boats, but a decrease in number, which is due to larger boats being introduced and the smaller sold, and at Lochboisdale there is a decrease in tonnage, owing to fewer second-class boats and more of third-class, being employed as compared with 1892.
5 weeks.	6 ,,	N.W., 8 to 10 miles off.	2,142	Herring, ling, and lobsters.	,,	5		
.	8 ,,	,,	1,213	Ling, eels, and flounders.	,,	2		
.	5 ,,	N.W. by S., 12 to 16 miles off.				1		
.	5 ,,	,,				1		
.	5 ,,	,,				.		
10 weeks.	6 ,,	,,	12,385	Herring, ling, eels, and lobsters.	Very good.	35		
.	.	W., 1 to 2 miles off.				.		
.	5 months.	S.W. off Barrahead 8 miles.				.		
.	5 ,,	,,				.		
			18,461			49		
May and June, and Sept. to Jan.	Feb. to May.	Minch and Lochinchard.						
,,	,,	,,						
,,	,,	,,	4,963	Herring, ling, cod, and lobsters.	Good.	4	Large increase.	The bulk of the fish in this section is caught by visiting fishermen, the natives being crofters, who only fish occasionally.
,,	,,	,,						
,,	,,	Lochinchard.						
Few caught.	,,	,,						
,,	,,	Minch and Lochlaxford.						
,,	,,	Minch.	1,370	Ling, cod, and lobsters.	,,	2	Increase.	,,
Oct. to Jan.	,,	Lochglendhu and Minch.						
,,	,,	,,		Herring.	,,	.	Slight decrease.	Large shoal of herrings went into Glendhu in October, but owing to a plentiful supply at other places, fishing ceased for want of buyers.
,,	,,	,,	1,378	,,	,,	.	,,	
,,	,,	,,		,,	,,	.	,,	
			7,711			6		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward,	13	231	4	26	97	291	114	548	3	9	6	33	16	318	
Loch Broom District—continued.															
Clashnessie (Sutherlandshire)	2	30	.	.	5	15	7	45	.	.	.	.	2	20	Nets, lobster creels, and lines.
Achnacarnin ,,	.	.	.	.	4	12	4	12	.	.	.	.	1	12	,,
Culkein (Stoer) ,,	.	.	.	.	4	12	4	12	.	.	.	.	2	14	,,
Raffin and Balnacladich ,,	.	.	.	.	6	18	6	18	.	.	1	3	1	24	,,
Clachtoll ,,	3	45	.	.	13	39	16	84	.	.	2	18	1	75	,,
Achmelvich ,,	2	30	.	.	4	12	6	42	.	.	.	.	2	24	,,
Lochinver and Strathan ,,	2	30	.	.	8	24	10	54	.	.	.	.	.	26	,,
Badnaban and Inverkirkaig ,,	1	15	.	.	10	30	11	45	.	.	.	.	1	27	,,
Achnahaird and Reff (Ross-shire)	1	15	1	5	8	24	10	44	.	.	1	3	1	35	,,
Altandhu ,,	3	45	5	25	9	27	17	97	.	.	1	3	2	45	,,
Polbain and Tanera ,,	3	45	9	45	12	36	24	126	.	.	3	23	2	78	,,
Achiltibuie and Badnescally ,,	.	.	5	25	16	48	21	73	.	.	.	.	2	64	,,
Polglass and Culnacraig ,,	.	.	2	10	10	30	12	40	.	.	1	5	1	54	,,
Isle Martin and Ardmair ,,	.	.	.	.	7	21	7	21	.	.	.	.	2	16	,,
Rhue and Morefield ,,	2	30	4	20	12	36	18	86	1	3	.	.	1	30	Drift-nets, and lines.
Ullapool ,,	2	30	3	15	35	105	40	150	8	30	.	.	3	105	,,
Leckmelm and Ardcharnoch ,,	.	.	.	.	5	15	5	15	.	.	.	.	1	6	,,
Letters, Ardendrean and Rheroy ,,	5	75	2	10	28	84	35	169	2	6	.	.	.	103	,,
Achmore and Scorraig ,,	1	15	1	5	10	30	12	50	.	.	2	6	2	62	Lobster creels, drift-nets, and lines
Charnoch and Badralloch ,,	.	.	1	5	9	27	10	32	.	.	1	3	1	41	,,
Ardessie and Badcall ,,	.	.	2	10	9	27	11	37	1	7	.	.	1	26	,,
Dunmuck and Badlurach ,,	.	.	.	.	12	36	12	36	.	.	2	6	2	76	,,
First and Second Coast ,,	.	.	.	.	6	18	6	18	.	.	.	.	1	20	,,
Sand and Laid ,,	2	30	1	5	8	24	11	59	.	.	1	15	2	60	,,
Achgarve and Mellon Udrigle ,,	1	15	2	10	3	9	6	34	.	.	2	16	2	22	,,
Opinin and Mellon Charles ,,	1	15	1	5	3	9	5	29	.	.	2	6	1	41	,,
Ormiscraig and Bualuiluib ,,	.	.	.	.	4	12	4	12	.	.	3	21	1	34	,,
Tenefelin and Aultbea ,,	1	15	.	.	4	12	5	27	.	.	1	3	1	23	,,
Poolewe and Nast ,,	.	.	.	.	7	21	7	21	.	.	.	.	1	38	,,
Inveresdale ,,	1	15	.	.	8	24	9	39	.	.	3	17	2	50	,,
Cove ,,	.	.	4	20	7	21	11	41	3	15	.	.	2	30	,,
Melvaig ,,	1	15	1	5	4	12	6	32	2	8	.	.	2	27	,,
Carry forward,	47	741	48	246	387	1,161	482	2,148	20	78	32	181	62	1,626	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with previous Years.	General Remarks.
Herring.	White Fish.							
			£ 7,711			6		
Oct. to Jan.	Feb. to May.	Lochglendhu and Minch.						
,,	,,	,,						
,,	,,	Mostly Minch.						
,,	,,	,,						
,,	,,	,,	1,937	Herring, cod, ling, and lobsters.	Good.	4	Large increase.	Shoal of herrings in vicinity of Lochinver during Aug., Sept., and Oct.
,,	,,	Minch and Lochroe.						
May and June, and Aug. to Oct.	,,	Minch and Lochinver.						
,,	,,	,,						
,,	Apr. till Feb.	Minch and vicinity of Summer Isles.						
,,	,,	,,						
,,	,,	,,	1,250	Herring, cod, lobsters, and haddocks.	,,	1	Increase.	Large crofting district, and fishing occasionally all the year round.
,,	,,	,,						
,,	,,	,, and Lochbroom.						
,,	,,	Lochbroom.						
,,	,,	,,						
,,	,,	,,	4,107	Herring, haddocks, and whiting.	,,	5	Large increase.	Large shoal of herrings in Lochbroom during Sept., Oct., and Nov.
,,	,,	,,						
,,	,,	,,						
Only when herrings go into Little-lochbroom.	No regular season, a few caught occasionally.	Little Lochbroom; seldom go outside.						
,,	,,	,,	322	Herring and lobsters.	,,	.	Slight increase.	Almost wholly crofters, who do not give much attention to fishing.
,,	,,	,,						
,,	,,	,,						
,,	,,	Minch.						
Only when herrings go into Lochewe.	,,	,,						
,,	,,	,,	931	Herring, eel, and lobsters.	,,	.	,,	Large, sparsely-populated section; natives devote some of their spare time to fishing.
,,	,,	,,						
,,	,,	,,						
,,	,,	,, and Lochewe.						
,,	,,	Lochewe.						
,,	,,	Minch and Lochewe.	405	Eel and lobsters.	,,	.	Decrease.	,,
Sept. and Oct.	Feb. Mar., and Apr.	Minch.						
,,	,,	Minch and Gairloch.						
			16,663			16		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	47	741	48	246	387	1,161	482	2,148	20	78	32	181	62	1,626	
Loch Broom District—continued.															
North Erradale (Ross-shire)	1	15	1	5	4	12	6	32	1	15	.	.	1	20	Lobster creels, drift nets, and lines.
Sand (Gairloch) ,,	.	.	3	15	4	12	7	27	.	.	1	3	2	48	,,
Strath ,,	1	15	8	40	5	15	14	70	.	.	.	.	2	64	,,
Badachro ,,	4	60	9	45	4	12	17	117	.	.	1	5	.	50	,,
Porthenderson ,,	2	30	3	15	4	12	9	57	.	12	.	.	1	37	,,
South Erradale ,,	.	.	1	5	2	6	3	11	.	.	.	.	2	17	,,
Charleston and Red Point ,,	2	30	.	.	3	9	5	39	1	15	.	.	1	20	,,
Totals, .	57	891	73	371	413	1,239	543	2,501	22	120	34	189	71	1,882	
Loch Carron and Skye District.															
Dibaig to Ardglass (Ross-shire)	2	40	.	.	6	12	8	52	1	18	.	.	.	22	Drift nets, great and small lines.
Lochs Torridon and Shieldaig ,,	2	30	7	49	14	28	23	107	.	4	.	.	6	60	,,
Ardheslaig to Loubane ,,	1	21	7	35	9	18	17	74	.	1	.	.	.	50	,,
Applecross to Ugas ,,	3	45	23	138	26	52	52	235	.	.	1	15	6	154	,,
Kishorn to Strome ,,	2	30	17	102	34	68	53	200	1	12	.	.	4	156	,,
Loch Carron ,,	1	11	20	140	36	72	57	223	.	.	.	.	5	170	,,
Plockton to Balmacara ,,	1	10	32	192	13	26	46	228	.	.	1	6	3	140	,,
Lochs Duich and Long ,,	.	.	7	28	50	100	57	128	3	12	.	.	6	120	,,
Loch Hourn and Glenelg (Inverness-shire)	.	.	9	27	35	70	44	97	1	.	.	5	6	80	,,
Troternish ,,	.	.	22	66	4	8	26	74	.	.	.	.	2	70	,,
Portree ,,	5	80	30	90	40	80	75	250	.	.	.	.	8	190	,,
Carry forward, .	17	2	174	867	267	534	458	1,668	6	47	2	26	46	1,212	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.							
			£ 16,663			16		
Sept. and Oct.	Feb., Mar., and Apr.	Minch and Gairloch.	268	Haddock, flounder, and lobsters.	Good.	.	De-crease.	Some fairly good fishermen in this section; most of the fish landed about Badachro, and sold to curers there.
,,	,,	,,						
,,	,,	,,						
,,	,,	,,	2,585	Herring, cod, saithe, and lobsters.	,,	4	In-crease.	,,
,,	,,	,,						
,,	,,	,,						
			19,516			☒		
Sept. to Dec., both inclusive.	Jan. to Mar., both inclusive.	All loch fishing in this district, the principal being Lochs Torridon, Hourn, Dunvegan, Scavaig, Slapin, and Eyshort.	2,653	Herrings.	Fair: from 900 to 1,200 to cran.	.	Large in-crease.	The herring fishing in this district may be considered to last from 1st Jul. to 31st Dec., as, when one loch gives out, the fishing fleet generally repair to another.
,,	,,	,,		,,	,,	.	,,	
,,	,,	,,	232	,,	,,	.	Slight in-crease.	Although at some creeks the white fishing is prosecuted all the year round, more or less, the principal fishing months are Jan., Feb., Mar., and Dec., the chief kinds of fish taken being cod, ling, eel, and saithe. The quality of the fish, generally, was very good, but prices were rather low.
,,	,,	,,		,,	,,	.	,,	
,,	,,	,,	2,526	Herrings, cod, ling, saithe, and eel.	Herrings good: generally from 700 to 1,200 to cran.	.	.	
,,	,,	,,		,,	Cod and ling, 8 and 7 to cwt. respectively.	6	Average	
,,	,,	,,		,,	,,	.	.	
,,	,,	,,	51	Herrings and saithe.	,,	.	De-crease.	
Aug. to Nov., both inclusive.	Jan., Apr., and May.	,,	10,420	Herrings, cod, and ling.	,,	2	Large in-crease.	Compared with previous years, the district, as a whole, shows a considerable increase, both as regards quantity and value.
,,	,,	,,	981	Herrings, cod, ling, and eel.	Herrings good: from 800 to 1,200 to cran.	.	Large de-crease.	
July to Oct., both inclusive.	Jan. to Apr., both inclusive.	,,		,,	,,	4	.	
			16,863			12		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	17	267	174	867	267	534	458	1,668	6	47	2	26	46	1,212	
Loch Carron and Skye District—continued.															
Balmeanoch to Sconser (Inverness-shire)	.	.	6	24	50	100	56	124	1	3	.	.	6	120	Drift net, great and small lines.
Luib to Stro-	1	30	15	60	46	92	62	182	1	8	.	.	4	125	,,
Broadford to Lussay ,,	1	21	18	72	30	60	49	153	.	.	2	4	6	110	,,
Kyleakin ,,	2	36	9	54	8	16	19	106	.	.	.	.	2	30	,,
Sleat ,,	1	25	33	132	56	112	90	269	.	.	.	.	6	220	,,
Uig to Snizort ,,	4	120	38	114	9	18	51	252	.	.	.	.	4	150	,,
Lyndale and Waternish ,,	.	.	29	87	10	20	39	107	.	.	.	.	2	120	,,
Stein and Dunvegan ,,	1	20	12	36	2	4	15	60	1	3	.	.	.	45	,,
Glendale and Bracadale ,,	1	16	15	45	1	2	17	63	2	6	.	.	.	45	,,
Strathaird ,,	.	.	6	24	17	34	23	58	3	8	.	.	.	48	,,
Lochs Slapin and Eyshort ,,	.	.	1	3	27	54	28	57	.	.	.	.	.	50	,,
Scalpa, Raasay, Rona, Croulin, and Soay ,,	1	16	10	60	30	60	41	136	1	2	.	.	4	90	,,
Totals, .	29	551	366	1,578	553	1,106	948	3,235	15	77	4	30	80	2,365	
Fort William District.															
Loch Nevis and Morar (Inverness)	2	36	17	68	37	74	56	178	.	.	6	8	4	112	Drift net and long line.
Arisaig and Loch Aylort ,,	.	.	5	40	9	18	14	58	3	18	.	.	.	32	,,
Similsary to Ockle Point and Eilan Shona ,,	.	.	8	32	5	10	13	42	.	2	1	.	2	38	,,
Do. (Argyll)	.	.	6	24	4	8	10	32	.	.	8	18	4	19	,,
Ockle Point to Loch Sunart ,,	2	80	11	77	4	8	17	165	.	.	3	16	3	40	,,
Lochs Sunart and Aline ,,	.	.	2	8	16	32	18	40	.	.	.	11	.	36	Drift net.
Loch Eil (South side) ,,	.	.	3	9	31	62	34	71	6	12	.	.	4	68	Drift net and long line.
Fort William, Loch Eil (North side) (Inverness)	.	.	4	12	9	18	13	30	6	14	.	.	1	26	,,
Corran (South) ,,	.	.	.	.	1	2	1	2	.	.	1	2	1	2	,,
Carry forward, .	4	116	56	270	116	232	176	618	15	46	19	55	19	373	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.							
			£ 16,863			12		
Jul. to Oct., both inclusive.	Jan. to Apr., both inclusive.	All loch fishing in this district, the principal being Lochs Torridon, Hourn, Dunvegan, Scavaig, Slapin, and Eyshort.	294	Herrings and eels.	Herrings good: from 800 to 1,200 to cran.	1	Average.	
,,	,,			,,	,,	.	,,	
,,	,,		1,385	Herrings, cod, and eel.	Cod and ling about 8 and 7 to cwt., respectively.	5	,,	
,,	,,	,,		,,	,,	3	,,	
Aug. to Nov.	Jan. to Dec.	,,	1,580	Herrings, cod, ling, saithe, and eel.	,,	2	,,	
July to Oct.	Feb. to Apr.	,,	944	,,	,,	.	Increase.	
July to Nov.	Jan. to Dec.	,,	2,559	Herrings, cod, ling, and lobsters.	Herrings good: 800 to 1,000 to cran. Cod, ling, &c., and lobsters large.	.	Average.	
,,	,,	,,		,,	,,	1	,,	
,,	,,	,,	841	Herrings, cod, and ling.	,,	1	Increase.	
Aug. to Dec.	Jan. to Apr.	,,	6,297	Herrings and cod.	Herrings very good; 700 to 900 to cran.	.	Large increase.	
,,	,,	,,		,,	,,	.	,,	
,,	,,	,,	232	Lobsters.	Large size.	.	,,	
			30,995			25		
Jan., and from Jul. to end of Nov.	During year.	Loch Nevis and off Mallaig.	536	Herrings, cod and ling.	Fair.	3	Poor.	Chief decrease in herrings.
Sept., Oct., and Nov.	,,	Loch-na-Nuagh.	377	Herrings, cod, and whelks.	Good.	.	Average.	
Nov.	Mar. and Apr.	Between Moidart and Muck.	315	Herrings and cod.	,,	3	,,	
,,	,,	,,	149	,,	,,	2	,,	
None.	During year.	Along coast.	390	Flounders and lobsters.	Fair.	.	Fair.	
Nov.	None.	Loch Sunart.	50	Herrings.	,,	.	,,	
Aug. and Sept.	,,	Loch Eil.	.	,,	Good.	.	Poor.	
,,	,,	,,	99					
Aug.	During year.	Loch Linnhe.	6	Saithe.	Fair.	.	Fair.	
			1,922			8		

(See preceding page.)

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Br. ught forward, .	4	116	56	270	116	232	176	618	15	46	19	55	19	373	
Fort William District—continued.															
Corran (North) (Argyll)	.	.	2	6	5	10	7	16	.	.	.	1	.	14	Drift net and long line.
Loch Leven and Kintallen (North) ,,	.	.	.	.	18	36	18	36	.	.	.	.	4	36	Drift and seine net, long line, and hand line.
,, (South) (Inverness)	.	.	1	2	1	2	2	4	.	.	3	6	2	4	Drift net and hand line.
Cuil, Point Appin, and Loch Creran (Argyll)	.	.	3	6	5	10	8	16	.	.	2	4	2	16	Drift net, long line, and hand line.
Loch Etive and Dunstaffnage ,,	.	.	.	.	4	8	4	8	.	.	.	.	.	8	Long line and hand line.
Oban ,,	.	.	17	34	11	22	28	56	1	2	.	.	5	48	Drift, seine and cod nets, and long line.
Lismore ,,	.	.	2	4	6	12	8	16	.	5	1	.	2	18	Drift net and long line.
Tobermory, &c. ,,	2	70	6	30	6	12	14	112	.	.	1	5	.	35	,,
Lochs Don, Spelve, and Buie ,,	.	.	1	3	9	18	10	21	1	2	.	.	3	20	,,
Carsaig to Kentra ,,	.	.	4	12	10	20	14	32	.	.	.	.	.	30	,,
Lochs Laich and Scriddan ,,	.	.	10	30	14	28	24	58	.	1	.	.	2	48	,,
Loch-na-Kiel, Ulva, and Loch Tuadh ,,	.	.	2	6	3	6	5	12	.	.	.	.	.	10	Long line.
Coll ,,	.	.	.	.	6	12	6	12	.	.	.	3	.	18	,,
Tiree ,,	2	30	35	140	30	60	67	230	.	1	3	.	8	201	Drift net and long line.
Iona ,,	.	.	.	.	5	10	5	10	.	.	.	.	.	10	Long line.
Canna (Inverness)	.	.	.	.	3	6	3	6	1	2	.	.	1	7	Drift net and long line.
Muck and Rum ,,	.	.	1	11	1	2	2	13	.	.	.	.	.	5	Long line.
Eigg ,,	.	.	.	.	4	8	4	8	.	.	.	.	.	12	Drift net and long line.
Totals, .	8	216	140	554	257	514	405	1,284	18	59	29	74	48	913	
Campbeltown District.															
Skipness and Clonaig (Argyll)	.	.	12	72	6	12	18	84	.	.	12	69	1	58	Net and line.
Carradale, Torrisdale, Saddell, Cour and Grogport ,,	1	15	47	282	5	10	53	307	.	.	14	55	1	176	Seine net, drift net, and line.
Campbeltown, Peninver, Kildalloig and Machrihanish ,,	24	360	136	812	15	30	175	1,202	.	.	25	232	18	544	,,
South end of Kintyre ,,	.	.	3	12	3	6	6	18	.	.	2	6	.	14	Line.
Sanda Island ,,	.	.	2	8	2	4	4	12	.	.	2	8	1	8	,,
Carry forward, .	25	375	200	1,186	31	62	256	1,623	.	.	55	370	21	800	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.							
			£ 1,922			8		
Aug.	During year.	Loch Linnhe.	95	Saithe.	Fair.	.	Fair.	
Nov., one week.	,,	Lochs Leven and Linnhe.	403	Herrings, cod, saithe, haddocks, whiting, and whelks.	,,	.	Poor.	
,,	,,	,,			,,	.	,,	
None.	,,	Loch Linnhe.		,,	,,	.	,,	
,,	None.	Along coast.		.	.	.	,,	
July, Aug., Oct., and Nov.	Feb., Mar., and Apr.	Between Oban, Lismore, and Mull.	1,151	Herrings, cod and whelks.	Good.	.	Good.	
None.	,,	,,	45	Cod.	,,	.	Poor.	
,,	Feb., Mar., Apr., and May.	Off Ardnamurchan and on Coll Banks.	2,218	Cod, ling, eel, lobsters, and whelks.	,,	1	Fair.	
Nov.	,,	Loch Buie.	308	Herrings, cod, and flounders.	Very good.	.	,,	
None.	During year.	Along coast.	1,113	Cod, saithe, and flounders.	Fair.	.	Very good.	
Oct. and Nov.	Feb., Mar., and Apr.	Loch Scriddan.	446	Herrings, cod, and whelks.	Good.	.	Average.	
None.	None.	Along coast.	276	Lobsters.	Fair.	.	Poor.	
,,	Mar., Apr., May, and June.	10 to 13 miles N.W. of Coll.	974	Cod, ling, and eel.	Good.	2	Average.	
,,	Apr., May, and June.	5 miles E., 7 miles S., and 15 miles W.S.W. off Hynish Point.	1,374	Cod, ling, and flounder.	,,	5	Good.	
,,	During year.	Along coast.	138	Cod and flounder.	Fair.	.	,,	
Aug., Sept., Oct., and Nov.	Mar., Apr., and May.	Vicinity of island, and 8 to 16 miles W.N.W.	2,148	Herrings, cod, and ling.	Good.	4	,,	Increase in herrings.
None.	,,	Coll and Canna Banks.	505	Cod, ling, and lobsters.	,,	1	,,	
,,	During year.	Around island.	232	Eel and whelks.	,,	.	,,	
			13,348			21		
1st Jun. to 31st Dec.	Jan. to Apr.	Upper reach, Sound of Kilbranan.	75	Herring.	Fair.	.	Unsuccessful.	Decrease in boats accounted for by a number being sold to other districts and useless boats being broken up.
,,	,,	Sound of Kilbranan.	11,883	Cod and herring.	,,	.	,,	
,,	Jan. to May, and Sept. to Dec.	Sound of Kilbranan and Clyde Firth.	14,446	Herring, cod, haddock, and whiting.	Good.	2	Improved.	Boats totally wrecked during the season, especially at Sound of Islay, in gale of 17th and 18th Nov.
.	Apr. to Sept.	Off Sanda Isle S.	111	Cod.	Fair.	.	Unsuccessful.	
.	,,	,,	152	Cod and saithe.	,,	1	Improved.	
			26,667			3		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward, .	25	375	200	1,186	31	62	256	1,623	.	.	55	370	21	800	
Campbeltown District—continued.															
Muasdale and Ballochantee (Argyll)	.	.	4	16	5	10	9	26	.	.	1	4	.	18	Line.
Gigha Island ,,	2	30	24	96	8	16	34	142	.	.	2	8	.	96	,,
Port-Ellen (Islay)	.	.	5	20	4	8	9	28	.	.	.	.	.	20	Drift net and line.
Port-Askaig and Bunnahaven ,,	.	.	7	28	4	8	11	36	2	8	.	.	.	24	,,
Portnahaven, Claddich, and Portwemyss ,,	3	45	59	236	65	130	127	411	.	.	10	6	.	339	Line.
Port-Charlotte and Bruichladdich ,,	.	.	12	48	10	20	22	68	2	8	.	.	.	39	,,
Bowmore ,,	.	.	14	56	8	16	22	72	.	4	.	.	.	40	,,
Loch Gruinart ,,	.	.	6	24	8	16	14	40	.	.	.	.	.	28	Drift net and line.
Jura Island ,,	.	.	4	16	36	72	40	88	.	.	2	4	.	40	,,
Colonsay ,,	.	.	9	36	13	26	22	62	.	.	3	8	.	32	,,
Totals, . .	30	450	344	1,762	192	384	566	2,596	4	20	73	400	21	1,476	
Inveraray District.															
Loch Feochan (Argyll)	.	.	.	.	4	8	4	8	.	.	4	8	None.	7	Creels for lobsters and hand lines for salthe.
Luing ,,	.	.	.	.	18	36	18	36	.	.	1	2	.	23	,,
Loch Melfort ,,	.	.	.	.	2	4	2	4	.	.	1	2	.	3	,,
Loch Craignish ,,	.	.	.	.	3	6	3	6	.	.	.	.	.	4	,,
Crinan ,,	.	.	.	.	3	6	3	6	.	.	1	2	.	5	,,
Loch Sweyn ,,	.	.	.	.	4	8	4	8	1	2	.	.	.	6	,,
Loch Kylesport ,,	.	.	.	.	3	6	3	6	1	2	.	.	.	3	,,
Tarbert ,,	.	.	94	564	21	63	115	627	.	.	14	63	.	263	Seine nets and drift nets for herring and mackerel.
Ardrishaig ,,	.	.	57	342	16	48	73	390	.	.	11	34	.	221	,,
Lochgilphead ,,	.	.	36	216	5	15	41	231	.	.	4	23	.	96	,,
Castleton ,,	.	.	17	102	2	6	19	108	.	.	6	26	.	56	,,
Lochgair ,,	.	.	11	66	2	6	13	72	.	.	2	6	.	32	,,
Minard ,,	.	.	13	78	3	6	16	84	.	.	1	6	.	34	,,
Crarae ,,	.	.	6	36	2	4	8	40	.	.	2	12	.	14	,,
Furnace ,,	.	.	8	48	3	6	11	54	.	.	.	4	.	26	,,
Kenmore ,,	.	.	2	12	1	2	3	14	.	.	1	6	.	4	Drift nets.
Inveraray ,,	.	.	9	36	1	2	10	38	.	.	3	16	.	14	,,
Cairndhu to Newton ,,	.	.	17	68	.	.	17	68	.	.	6	42	.	27	,,
Otter to Ardlamont ,,	.	.	20	80	.	.	20	80	.	.	6	44	.	36	,,
Totals, .	.	.	290	1,648	93	232	383	1,880	2	4	63	296	.	974	

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.							
			£ 26,667			3		
.	Feb. to Apr.	Off Gigha Isle S.	315	Cod.	Good.	2	Falling off.	
.	,,	,,	877	,,	,,	6	,,	
15th July to 31st Dec.	At any time.	Mull of Oa, S.	749	Flounder.	,,	.	Unsuccessful.	Considerable quantity of herrings caught and shipped in Loch Tarbert Jura, reported to Port-Askaig correspondent by steamers calling there and reporting quantity to fish merchants, and included in his returns.
,,	Jan. to May.	Sound of Islay and Loch Tarbert, Jura.	32,920	Herring and saithe.	Excellent.	3	Improved.	
.	Apr. to Aug.	10 miles Rhinns Isle.	1,745	Cod, ling, and saithe.	Good.	9	,,	
.	Jan. to Jul.	Lochindaal.	547	Cod and flounder.	,,	.	Falling off.	
.	,,	,,	1,010	,,	,,	.	Average.	
15th July to 31st Dec.	,,	Near Rhuvaal Point.	2,621	Herring and saithe.	Excellent.	10	Falling off.	
,,	At any time.	Small Isles and Loch Tarbert.	154	Cod and saithe.	Good.	2	.	
,,	Feb. to May.	All round the Isle.	551	Herring and cod.	,,	3	Not so good.	
			68,156			38		
.	Lobster fishing May to Dec., summer time for saithe.	About the Island of Luing and Sound of Jura for lobsters and saithe.	796	Lobsters, saithe, and whelks.	Good.	.	.	Much about the same as previous years. No regular fishing in this section—saithe, lobsters, whelks, and a few herrings being the only kinds of fish caught.
,,	,,	,,		,,	,,	.	.	
,,	,,	,,		,,	,,	.	.	
,,	,,	,,		,,	,,	.	.	
,,	,,	,,		,,	,,	.	.	
,,	,,	,,		,,	,,	.	.	
From 1st June to close of Dec.	From the beginning of Jan. to the close of May.	Upper Lochfyne, off Minard, for herring, and lower Lochfyne for white fish.	17,450	Herring, mackerel, cod, haddock, whiting, and saithe.	Generally good.	4	.	The catch of herrings compared favourably with previous years. Prices, however, much lower than in some recent previous years. Total crans landed, 40,793, as compared with 50,158 crans in 1892.
,,	,,	,,	18,311	,,	,,	4	.	
,,	,,	,,		,,	All kinds of white fish usually poor.	1	.	
,,	,,	,,		,,	,,	.	.	
,,	,,	,,		,,	,,	.	.	
,,	,,	,,		,,	,,	1	.	
,,	,,	,,		,,	,,	.	.	
Mackerel, June, Jul Aug., and Sept.	,,	,,	8,017	,,	,,	.	.	The white and shell fisheries vary little from year to year; value of both amounted to only £3,633, as compared with £977 for mackerel and £40,517 for herrings.
,,	,,	,,		,,	,,	.	.	
,,	,,	,,		,,	,,	1	.	
,,	,,	,,	553	,,	,,	.	.	
,,	,,	,,		,,	,,	.	.	
			45,127			11		

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlicensed.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton	No.	Ton.	No.	Ton.	No.	Ton.			
Rothesay District.															
Rothesay (Buteshire)	.	.	16	64	21	42	37	106	2	4	.	.	.	36	Drift-net and lines.
Port-Bannatyne and North Bute ,,	.	.	11	55	5	10	16	65	.	.	3	6	3	16	,,
St Ninians ,,	.	.	11	55	4	8	15	63	.	.	2	24	2	16	,,
Kilchattan and Schoolac ,,	.	.	3	15	11	22	14	37	2	4	.	.	.	12	,,
Kyles of Bute (Argyleshire)	.	.	20	100	15	30	35	130	6	18	.	.	5	56	,,
Toward to Holy Loch ,,	.	.	5	15	12	24	17	39	.	.	1	3	.	19	Principally lines.
Blairmore, Ardentinny, and Lochgoil ,,	.	.	7	21	5	10	12	31	.	.	.	.	.	20	Drift and trammel nets.
Kilcreggan to Arrochar, (Dumbartonshire)	.	.	13	39	9	18	22	57	.	.	2	3	.	26	,,
Lochranza and Catacol (Buteshire)	.	.	18	90	2	4	20	94	.	.	.	.	.	43	Drift nets.
Pirnmill to Blackwater ,,	.	.	18	90	3	6	21	96	.	.	.	.	2	34	Drift and seine nets.
Blackwater to Whiting Bay ,,	.	.	.	.	4	8	4	8	.	.	4	17	.	9	Lobster creels and lines.
Whiting Bay to Lamlash ,,	.	.	1	5	4	8	5	13	.	.	3	12	.	11	Principally lines.
Brodick and Corrie ,,	.	.	1	5	3	6	4	11	.	.	2	4	.	8	,,
. . . .	.	.	.	.	.	.	.	.	.	.	.	.	.	.	,,
Totals, .	.	.	124	554	98	196	222	750	10	26	17	69	12	306	
Greenock District.															
Gareloch (Dumbarton)	.	.	8	24	13	13	21	37	2	6	.	.	None.	33	Nets and lines.
Helensburgh ,,	.	.	5	15	6	6	11	21	.	.	2	2	,,	18	,,
Glasgow (Lanark)	.	.	1	3	3	3	4	6	.	.	.	.	,,	10	,,
Paisley (Renfrew)	.	.	1	3	1	1	2	4	2	2	.	.	,,	4	,,
Port-Glasgow ,,	.	.	25	75	22	22	47	97	.	.	2	2	,,	76	,,
Greenock ,,	.	.	13	39	50	50	63	89	.	.	.	.	,,	74	,,
Gourock ,,	.	.	3	12	4	4	7	16	2	9	.	.	,,	12	,,
Ashton ,,	.	.	.	.	1	2	1	2	.	.	1	2	,,	2	,,
Inverkip ,,	.	.	.	.	1	2	1	2	1	2	.	.	,,	2	,,
Largs (Ayr)	.	.	3	9	20	20	23	29	.	.	.	.	,,	34	,,
Millport ,,	.	.	6	30	11	11	17	41	1	5	.	.	,,	28	,,
Fairlie ,,	.	.	.	.	2	4	2	4	.	.	.	.	,,	4	,,
Portincross .	.	.	.	.	4	12	4	12	.	.	3	13	,,	4	Nets.
Carry forward, .	.	.	65	210	138	150	203	360	8	24	8	19	.	301	

Note.—In addition to the above, there were

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.							
June to Oct.	Aug. to June.	Between Bute and Cumbrae Islands.	3,124	Herring, cod, haddock, and whiting.	Good	2	De-crease.	There is a net decrease of 7 in the number of boats, and of £713 in the value of fish landed as compared with the previous year.
,,	Oct. to May.	Loch Striven and Kyles of Bute.		,,	,,	.	,,	
,,	Oct. to Apr.	Off Skipness.	442	Haddock and whiting.	,,	.	,,	
,,	Sept. to June.	Between Bute and Cumbrae.	323	Herring, cod, haddock, and whiting.	,,	.	,,	
,,	Oct. to May.	Kyles of Bute and Lochfyne.	998	,,	,,	1	In-crease.	
June to Aug.	Aug. to June.	Upper Clyde Estuary.	634	Cod, haddock, and whiting.	,,	.	De-crease.	
,,	Sept. to May.	Lochs Long and Goil.	502	Herring, cod, haddock, and whiting.	,,	.	,,	
,,	,,	,,		,,	,,	.	,,	
June to Nov.	Nov. to Mar.	Kilbranan Sound.	1,390	Herring.	,,	2	In-crease.	
,,	,,	,,	189	Herring, cod, and haddock.	,,	.	De-crease.	
,,	Mar. to Oct.	S. and E. coast of Arran.		Lobsters, haddock, and whiting.	,,	.	,,	
,,	Aug. to June.	,,	791	,,	,,	.	In-crease.	
,,	,,	,,		,,	,,	.	,,	
,,	,,	,,	394	Herring.	,,	.	,,	Shipped by steamers on fishing grounds in district.
			8,787			5		
4 months.	8 months.	In Gareloch.	62	Mackerel.	Good.	Nil.	Poorer since 1890.	
,,	,,	Wemyss Bay and Loch Long, &c.	1,404	Herring, cod, saithe, and haddocks.	Fairly good.	,,	,,	
,,	,,	,,	.	.	,,	,,	,,	
,,	,,	,,	.	.	,,	,,	,,	
,,	,,	,,	2,632	Flounders.	,,	,,	,,	
,,	,,	Gareloch and Loch Long.	1,642	Herring and flounder.	,,	,,	,,	
,,	,,	,,	147	Herring and haddock.	Good.	,,	,,	
,,	,,	,,	.	.	.	,,	,,	
,,	,,	,,	.	.	.	,,	,,	
,,	,,	Off Largs.	1,875	Herring, cod, haddock, and flounder.	Fairly good.	,,	,,	
,,	,,	Off Cumbraes.	754	Herring, cod, and haddock.	,,	,,	,,	
,,	,,	Off Fairlie.	88	Cod and haddocks.	Good.	,,	,,	
,,	,,	Off Largs and off Portincross.	.	.		,,	,,	
			8,604					

2 small sailing trawlers fishing from Rothesay.

APPENDIX A.—

Station or Creek.	Fishing Boats and Vessels (excluding Trawlers) belonging to Creek.												Seaworthy Boats Unlaunched.	Resident Fishermen and Boys.	Methods of Fishing Pursued.
	1st Class.		2nd Class.		3rd Class.		Total.		Increase on 1892.		Decrease from 1892.				
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.			
Brought forward,			65	210	138	150	203	360	8	24	8	19	.	301	
Greenock District—continued.															
Saltcoats (Ayr)	.	.	21	126	16	48	37	174	.	.	.	.	3	56	Nets and lines.
Irvine ,,	.	.	18	90	18	36	36	126	8	16	.	.	8	54	,,
Troon ,,	.	.	8	32	6	12	14	44	.	.	6	30	6	14	,,
Totals, . .	.	.	112	458	178	246	290	704	16	40	14	49	17	425	
Ballantrae District.															
Annan (Dumfries)	.	.	.	.	5	5	5	5	.	.	4	4	.	102	Beam trawls.
Powfoot ,,	.	.	.	.	.	.	.	.	.	.	.	.	.	25	Stake nets.
Carsethorn (Kirkcudbright)	.	.	.	.	6	24	6	24	.	.	.	.	.	17	,,
Kirkcudbright ,,	.	.	.	.	11	11	11	11	.	.	.	.	.	15	Hand lines.
Garlieston and Creetown (Wigtown)	.	.	4	20	26	26	30	46	.	.	.	.	.	18	,,
Whithorn Isle ,,	.	.	.	.	14	14	14	14	.	.	.	.	.	18	Hand and long lines.
Port William ,,	.	.	4	20	23	23	27	43	4	20	.	.	.	30	,,
Glenluce ,,	.	.	4	12	7	7	11	19	.	.	.	.	.	28	Flounder nets.
Sandhead ,,	.	.	2	12	13	13	15	25	1	6	.	.	.	20	Nets and lines.
Drumore ,,	.	.	4	16	4	4	8	20	.	.	.	.	.	26	,,
Portlogan ,,	.	.	.	.	5	5	5	5	.	.	.	.	.	12	Crab creels.
Port Patrick ,,	.	.	4	16	18	27	22	43	1	7	.	.	.	60	Great lines.
Stewarton ,,	.	.	2	8	12	18	14	26	1	5	.	.	.	20	,,
Stranraer ,,	1	10	18	54	15	15	34	79	.	.	.	.	.	70	Nets and lines.
Cairnryan ,,	.	.	2	10	6	9	8	19	.	.	.	.	.	24	,,
Ballantrae (Ayr)	.	.	32	160	5	10	37	170	.	.	7	20	2	84	,,
Carleton ,,	1	10	7	35	2	4	10	49	.	.	5	15	1	36	Herring and cod nets.
Girvan ,,	1	10	60	240	13	26	74	276	10	44	.	.	1	145	Nets and lines.
Maidens ,,	.	.	18	72	16	16	34	88	.	.	.	.	.	58	,,
Dunure ,,	.	.	41	164	12	12	53	176	.	.	.	.	.	76	,,
Ayr ,,	.	.	16	64	16	16	32	80	.	.	.	.	.	50	,,
Totals, . .	3	30	218	903	229	285	450	1,218	17	82	16	39	4	934	

Note.— In addition to the above, there were
Do. do.
Do. do.

* There are 31 curers in this district who fit out curing vessels for the West Coast loch fishing

No. II.—*continued.*

Duration of Fishing Season.		Position of Principal Fishing Grounds.	Value of all Fish Landed.	Principal Kinds of Fish Landed.	Quality of Fish.	No. of Curing Stations.	General Results compared with Previous Years.	General Remarks.
Herring.	White Fish.							
			£ 8,604					
4 months.	8 months.	Irvine Bay, &c.	1,913	Herring, cod, haddock, and flounder.	Fairly good.	Nil.	Poorer since 1890.	
,,	,,	,,	839	Herring, cod, and haddock.	,,	,,	,,	
,,	,,	Off Troon.	123	Mackerel.	Good.	,,	,,	
			11,479			Nil.*		
.	Sept. to Dec.	Solway.	2,667	Flounders and shrimps.	Good.	.	De-crease.	Beam trawls for flounders and shrimps.
.	,,	Shore of Solway.	465	Flounders.	,,	.	,,	Stake nets set on the shore.
.	,,	,,		,,	,,	.	,,	
.	All the year.	Off the station.		,,	,,	.	,,	
.	,,	,,	673	Cod and sole.	,,	.	,,	
.	,,	,,	163	Mostly cod.	,,	.	In-crease.	
.	,,	,,	93	,,	,,	.	De-crease.	
May to Aug.	Sept to Dec.	Luce Bay.	250	Herrings and flounders.	Superior.	.	,,	Herring fishing in Luce Bay almost a failure.
,,	,,	,,	320	Herrings and cod.	,,	.	,,	
,,	,,	,,	318	Cod and saithe.	Good.	.	Similar.	
,,	,,	Off the station.	199	Saithe.	Fair.	.	,,	
,,	,,	Irish Channel.	759	Cod.	Superior.	.	De-crease.	
,,	,,	,,		,,	,,	.	,,	
Nov. to Mar.	All the year.	Lochryan and Firth of Clyde.	3,688	Herrings, cod, haddock, &c.	Fair.	2	In-crease.	
,,	,,	,,		,,	Good.	.	,,	
May to Aug. and from Nov. to Mar.	Jan. to Apr.	Ballantrae banks and Firth of Clyde for cod, haddock, whiting, turbot, &c.	1,204	Herring, cod, and turbot.	,,	3	,,	Drift and trammel nets used for herring fishing. Great lines and gil nets for cod, ling, saithe, and turbot. Long lines for haddocks, whiting, and flounders. Cod fishing good. Herring fishing nearly a failure, winter and summer.
,,	,,	,,	4,142	,,	,,	.	De-crease.	
,,	,,	,,		Herring, cod, haddock, &c.	,,	5	,,	
,,	,,	,,	891	,,	,,	.	,,	
,,	,,	,,	2,349	,,	,,	.	,,	
,,	,,	,,	1,852	,,	,,	3	,,	
			29,033			13		

17 small sailing trawlers fishing from Greenock district.
51 small sailing trawlers fishing from Annan.
and land the fish in Glasgow, where they are repacked in barrels, half barrels, and kegs.

APPENDIX A.—No. III.

RETURN, for the Year 1893, showing the largest Number of Boats, Decked and Undecked, *irrespective* of the places to which they belong, employed fishing for Herrings, as well as the largest Number of Persons engaged in that industry, in each District in Scotland at *one* time.

Districts where the Boats were employed at the Herring Fishery.	Boats.	Fishermen and Boys.	Curers.	Coopers.	Gutters and Packers.	Labourers.	Total Persons Employed.
Eyemouth,	210	1,243	50	122	1,031	261	2,707
Leith,	94	400	18	42	200	182	842
Anstruther,	101	707	39	29	105	26	906
Montrose,	150	1,024	14	88	691	86	1,903
Stonehaven,	68	443	11	26	206	34	720
Aberdeen,	345	2,280	52	235	2,213	552	5,332
Peterhead,	577	3,989	84	364	2,117	198	6,752
Fraserburgh,	805	5,611	71	471	3,206	435	9,794
Banff,	104	728	19	52	356	48	1,203
Buckie,	123	738	19	58	447	29	1,291
Findhorn,	97	582	10	32	252	25	901
Cromarty,	52	312	3	16	168	22	521
Helmsdale,	125	752	13	58	438	36	1,297
Lybster,	61	381	13	31	237	17	679
Wick,	318	2,220	121	223	1,279	149	3,992
Orkney,	340	2,380	34	68	418	37	2,937
Shetland,	466	3,023	47	182	1,446	50	4,748
Stornoway,	721	5,047	102	282	2,328	402	8,161
Barra,	190	1,178	35	58	651	33	1,955
Loch Broom,	187	841	24	14	144	28	1,051
Loch Carron and Skye,	480	1,680	91	82	493	67	2,413
Fort-William,	61	216	5	8	45	1	275
Campbeltown,	309	1,082	11	26	87	38	1,244
Inveraray,	295	1,016	21	4	69	28	1,138
Rothesay,	120	299	5	2	18	10	334
Greenock,	66	228	31	36	356	88	739
Ballantrae,	192	768	27	24	38	82	939

APPENDIX B.

TOTAL QUANTITY OF FISH LANDED.—STATEMENT, by Districts, of the Total Quantity and Value of the different kinds of Fish landed in SCOTLAND, in the Year 1893, compared with 1892.

DISTRICTS.	Herring. Net.		Sprat. Net.		Sparling. Net.		Mackerel. Net.		TOTAL.	
EAST COAST.	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
Eyemouth,	79,617	12,269	...	...	...	...	5	3	79,622	12,272
Leith,	91,076	15,582	10,524	915	38	218	2	3	101,640	16,718
Anstruther,	104,981	15,858	1,000	37	297	1,173	...	...	106,278	17,068
Montrose,	141,136	22,095	391	28	12	53	21	35	141,560	22,211
Stonehaven,	54,664	8,311	...	...	...	...	...	...	54,664	8,311
Aberdeen,	412,934	60,745	...	...	...	...	...	...	412,934	60,745
Peterhead,	703,047½	124,614	...	...	...	...	...	...	703,047½	124,614
Fraserburgh,	907,275	164,247	...	...	...	...	...	...	907,275	164,247
Banff,	85,215	12,682	...	...	...	...	11	9	85,226	12,691
Buckie,	89,593	13,983	...	...	...	...	5	2	89,598	13,985
Findhorn,	44,261	7,461	45,950	3,377	...	...	2¼	4	90,213¼	10,842
Cromarty,	19,535	3,347	450	36	...	...	1	1	19,986	3,384
Helmsdale,	65,018	12,701	...	...	...	...	...	...	65,018	12,701
Lybster,	26,847	4,416	...	...	...	...	...	...	26,847	4,416
Wick,	333,147	71,648	...	...	...	...	10	5	333,157	71,653
East Coast Totals carried down,	3,158,346½	549,959	58,315	4,393	347	1,444	57¼	62	3,217,065¾	555,858
Orkney and Shetland.										
Orkney,	105,471	25,856	...	...	...	...	1	...	105,472	25,856
Shetland,	229,447	43,157	...	...	...	...	...	...	229,447	43,157
Orkney and Shetland Totals carried down,	334,918	69,013	...	...	...	...	1	...	334,919	69,013
WEST COAST.										
Stornoway,	119,099	34,650	...	...	...	...	16	14	119,115	34,664
Barra,	17,736	7,978	...	...	...	...	190	21	17,926	7,999
Loch Broom,	131,633	11,393	...	...	...	...	14	3	131,647	11,396
Loch Carron and Skye,	223,615	23,855	...	...	...	...	...	...	223,615	23,855
Fort William,	19,679	2,618	...	...	...	...	20	15	19,699	2,633
Campbeltown,	247,975	55,959	...	...	...	...	364	272	248,339	56,231
Inveraray,	142,765	40,517	...	...	...	...	1,208	977	143,973	41,494
Rothesay,	15,206	4,818	...	...	...	...	36	76	15,242	4,894
Greenock,	6,422½	2,895	4	1	...	...	218½	255	6,645	3,151
Ballantrae,	7,196	2,662	...	...	29½	135	776	549	8,001½	3,346
West Coast Totals carried down,	931,326½	187,345	4	1	29½	135	2,842½	2,182	934,202½	189,663
Totals brought down.										
East Coast,	3,158,346½	549,959	58,315	4,393	347	1,444	57¼	62	3,217,065¾	555,858
Orkney and Shetland,	334,918	69,013	...	...	...	...	1	...	334,919	69,013
West Coast,	931,326½	187,345	4	1	29½	135	2,842½	2,182	934,202½	189,663
Grand Totals for 1893,	4,424,591	806,317	58,319	4,394	376½	1,579	2,900¾	2,244	4,486,187½	814,534
Grand Totals for 1892,	3,655,116	756,136	5,908	848	276½	1,044	3,470¾	1,615	3,664,771¼	759,643
Increase in 1893,	769,475	50,181	52,411	3,546	100	535	...	629	821,416	54,891
Decrease in 1893,	...	...	...	...	..	...	570	...	...	...

APPENDIX B.—

TOTAL QUANTITY OF FISH LANDED.—STATEMENT, by Districts, of the ROUND in the year 1893,

DISTRICTS.	Cod.				Ling.			
	Line.		Trawl.		Line.		Trawl.	
EAST COAST.	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
Eyemouth,	3,029	1,196	...	...	67	41	...	...
Leith,	22,777	13,218	20,743	11,059	1,931	1,291	859	585
Anstruther,	48,864	15,419	...	...	4,447	1,468	...	...
Montrose,	16,734	5,680	4,147	1,576	493	219	118	56
Stonehaven,	9,096	2,568	...	...	485	157	...	...
Aberdeen,	44,081	22,171	28,006	12,127	14,889	5,228	3,629	1,403
Peterhead,	24,809	8,492	...	...	4,820	1,766	...	...
Fraserburgh,	10,129	3,266	69	30	6,010	2,020	15	8
Banff,	6,897	2,128	...	...	661	241	...	...
Buckie,	4,428	1,951	...	...	3,824	1,158	...	...
Findhorn,	6,109	3,152	...	...	790	320	...	...
Cromarty,	2,473	974	...	...	6	2	...	...
Helmsdale,	3,921	1,335	...	...	41	21	...	...
Lybster,	2,176	764	...	...	30	18	...	...
Wick,	17,545	7,461	...	...	7,523	2,574	...	...
East Coast Totals carried down,	223,068	89,775	52,965	24,792	46,017	16,524	4,621	2,052
Orkney and Shetland.								
Orkney,	20,283	6,428	...	...	7,257	2,459	...	...
Shetland,	74,730	16,334	...	...	39,780	8,938	...	...
Orkney and Shetland Totals carried down,	95,013	22,762	...	...	47,037	11,397	...	...
WEST COAST.								
Stornoway,	15,654	3,615	...	...	65,815	20,499	...	...
Barra,	2,380	495	...	...	13,443	3,449	...	...
Loch Broom,	7,662	1,970	...	...	4,331	1,444	...	...
Loch Carron and Skye,	3,497	1,011	...	...	2,042	744	...	...
Fort William,	5,980	2,150	...	...	6,558	2,037	...	...
Campbeltown,	7,726	3,270	...	...	1,115	446	...	...
Inveraray,	1,046	490	...	...	105	46	...	...
Rothesay,	962	665	...	...	43	31	...	...
Greenock,	701½	661	16	12	183½	155	...	...
Ballantrae,	9,481	4,190	...	...	532	284	...	...
West Coast Totals carried down,	55,089½	18,517	16	12	94,167½	29,135	...	...
Totals brought down.								
East Coast,	223,068	89,775	52,965	24,792	46,017	16,524	4,621	2,052
Orkney and Shetland,	95,013	22,762	...	...	47,037	11,397	...	...
West Coast,	55,089½	18,517	16	12	94,167½	29,135	...	...
Grand Totals for 1893,	373,170½	131,054	52,981	24,804	187,221½	57,056	4,621	2,052
Grand Totals for 1892,	427,431	151,715	39,576	19,848	150,725½	48,675½	2,616	1,220½
Increase in 1893,	...	...	13,405	4,956	36,496	8,380½	2,005	831½
Decrease in 1893,	54,260½	20,661	...	...	...	...	...	...

continued.

Total Quantity and Value of the different kinds of Fish landed in SCOTLAND compared with 1892.

FISH.									
TORSK (TUSK).		SAITHE (COAL FISH.)				HADDOCK.			
Line.		Line.		Trawl.		Line.		Trawl.	
Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
...	...	42	8	...	...	22,672	13,642	...	...
...	...	2,213	745	529	229	28,081	18,439	53,421	29,016
24	6	4,023	381	...	...	22,037	13,673	...	...
...	...	498	73	146	36	61,376	36,736	11,676	6,105
...	...	527	74	...	...	19,857	9,045	...	...
874	169	6,204	740	2,379	750	37,097	20,773	176,264	110,762
930	126	3,081	342	...	...	38,212	21,046	...	...
599	77	2,032	442	...	...	28,774	18,077	401	230
50	14	902	193	...	...	44,373	23,648	...	...
150	26	402	48	...	...	41,440	23,468	...	...
16	8	205	49	...	...	24,261	13,359	...	...
...	...	39	11	...	...	9,365	4,466	...	...
...	...	80	11	...	...	4,258	1,691	...	...
...	...	549	85	...	...	1,298	434	...	...
239	63	5,655	970	...	...	7,222	2,765	...	...
2,882	489	26,452	4,172	3,054	1,015	390,323	221,262	241,762	146,113
1,065	225	3,632	486	...	...	6,978	1,907	...	...
6,027	911	26,102	2,068	...	...	23,093	6,735	...	...
7,092	1,136	29,734	2,554	...	...	30,071	8,642	...	...
1,696	340	6,308	716	...	...	12,527	4,692	...	...
251	37	230	27	...	...	129	34	...	...
20	5	3,408	356	...	...	2,168	608	...	...
...	...	3,845	541	...	...	340	143	...	...
22	5	2,316	566	...	...	119	107	...	...
...	...	3,956¾	934	...	...	1,313½	1,069	...	...
...	...	2,000	440	...	...	867	552	...	...
...	...	593	229	...	...	1,143	1,014	...	...
...	...	222	98	...	...	869½	896	10	9
...	...	696	163	...	...	3,141	2,306	...	...
1,989	387	23,574¾	4,070	...	...	22,617	11,421	10	9
2,882	489	26,452	4,172	3,054	1,015	390,323	221,262	241,762	146,113
7,092	1,136	29,734	2,554	...	...	30,071	8,642	...	...
1,989	387	23,574¾	4,070	...	...	22,617	11,421	10	9
11,963	2,012	79,760¾	10,796	3,054	1,015	443,011	241,325	241,772	146,122
5,886	1,014	79,606	10,445	1,664	657	512,777	276,417	210,008	117,860
6,077	998	154¾	351	1,390	358	...	...	31,764	28,262
...	...	...	...	...	...	69,766	35,092	...	...

APPENDIX B.—

TOTAL QUANTITY OF FISH LANDED.—STATEMENT, by Districts, of the in the year 1893,

DISTRICTS.	ROUND FISH					
	Whiting.				Conger	
	Line.		Trawl.		Line.	
	Cwts.	£	Cwts.	£	Cwts.	£
EAST COAST.						
Eyemouth,	1,362	1,144	...	...	26	19
Leith,	2,574	1,436	3,131	1,943	190	273
Anstruther,	1,085	528	...	...	85	54
Montrose,	1,663	966	389	169	81	46
Stonehaven,	1,275	692	...	...	120	80
Aberdeen,	5,996	4,676	3,845	2,144	340	244
Peterhead,	1,313	420	...	...	209	119
Fraserburgh,	302	137	6	4	255	135
Banff,	1,954	979	...	...	40	25
Buckie,	125	25	...	...	29	7
Findhorn,	1,499	492	...	...	18	7
Cromarty,	187	65	...	...	37	15
Helmsdale,	173	56	...	...	649½	255
Lybster,	5	1	...	...	78	33
Wick,	586	132	...	...	242	171
East Coast Totals carried down,	20,099	11,749	7,371	4,260	2,399½	1,483
Orkney and Shetland.						
Orkney,	4	1	...	...	82	31
Shetland,	...	...	...	...	...	...
Orkney and Shetland Totals carried down,	4	1	...	...	82	31
WEST COAST.						
Stornoway,	173	60	...	...	4,433	2,017
Barra,	...	...	...	...	1,546	668
Loch Broom,	465	126	...	...	1,338	620
Loch Carron and Skye,	99	36	...	...	709	312
Fort William,	67	73	...	...	2,672	1,616
Campbeltown,	1,541	1,332	...	...	427	239
Inveraray,	462	280	...	...	254	157
Rothesay,	717	608	...	...	128	66
Greenock,	410	421	...	...	374½	181
Ballantrae,	2,428	1,767	...	...	435	313
West Coast Totals carried down,	6,362	4,703	...	...	12,316½	6,189
Totals brought down.						
East Coast,	20,099	11,749	7,371	4,260	2,399½	1,483
Orkney and Shetland,	4	1	...	...	82	31
West Coast,	6,362	4,703	...	...	12,316½	6,189
Grand Totals for 1893,	26,465	16,453	7,371	4,260	14,798	7,703
Grand Totals for 1892,	41,846	22,194½	7,256	3,422½	11,538	6,063
Increase in 1893,	...	...	115	837½	3,260	1,640
Decrease in 1893,	15,381	5,741½	...	...	...	...

continued.

Total Quantity and Value of the different kinds of Fish landed in SCOTLAND compared with 1892.

—continued.

EEL.		TOTAL.				GRAND TOTAL.	
Trawl.		Line.		Trawl.			
Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
...	...	27,198	16,050	...	..	27,198	16,050
27	13	57,766	35,402	78,710	42,845	136,476	78,247
...	...	80,565	31,529	...	...	80,565	31,529
3	2	80,845	43,720	16,479	7,944	97,324	51,664
...	...	31,360	12,616	...	...	31,360	12,616
14	7	109,481	54,001	214,137	127,193	323,618	181,194
...	...	73,374	32,311	...	...	73,374	32,311
...	...	48,101	24,154	491	272	48,592	24,426
...	...	54,877	27,228	...	...	54,877	27,228
...	...	50,398	26,683	...	...	50,398	26,683
...	...	32,898	17,387	...	...	32,898	17,387
...	...	12,107	5,533	...	...	12,107	5,533
...	...	9,122½	3,369	...	...	9,122½	3,369
...	...	4,136	1,335	...	...	4,136	1,335
...	...	39,012	14,136	...	...	39,012	14,136
44	22	711,240½	345,454	309,817	178,254	1,021,057½	523,708
...	...	39,301	11,537	...	...	39,301	11,537
...	...	169,732	34,986	...	...	169,732	34,986
...	...	209,033	46,523	...	...	209,033	46,523
...	...	106,606	31,939	...	...	106,606	31,939
...	...	17,979	4,710	...	...	17,979	4,710
...	...	19,392	5,129	...	...	19,392	5,129
...	...	10,532	2,787	...	...	10,532	2,787
...	...	17,734	6,554	...	...	17,734	6,554
...	...	16,079¼	7,290	...	...	16,079¼	7,290
...	...	4,734	1,965	...	...	4,734	1,965
...	...	3,586	2,613	...	...	3,586	2,613
...	...	2,761	2,412	26	21	2,787	2 433
19	29	16,713	9,023	19	29	16,732	9,052
19	29	216,116¼	74,422	45	50	216,161¼	74,472
44	22	711,240½	345,454	309,817	178,254	1,021,057½	523,708
...	...	209,033	46,523	...	...	209,033	46,523
19	29	216,116¼	74,422	45	50	216,161¼	74,472
63	51	1,136,389¾	466,399	309,862	178,304	1,446,251¾	644,703
80	54	1,229,809½	516,524	261,200	143,062	1,491,009½	659,586
...	...	...	...	48,662	35,242	...	...
17	3	93,419¾	50,125	...	...	44,757¾	14,883

APPENDIX B.—

TOTAL QUANTITY OF FISH LANDED.—STATEMENT, by Districts, of the in the year 1893,

DISTRICTS.	FLAT									
	TURBOT.				HALIBUT.				SOLE	
	Line.		Trawl.		Line.		Trawl.		Line.	
EAST COAST.	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
Eyemouth,	¼	1	...	...	4	10	...	...	...	...
Leith,	116	239	686½	2,124	285	693	6½	15	17	30
Anstruther,	8	15	..	...	840	1,096	...	...	...	...
Montrose,	19	44	273	922	148	204	6	10	74	111
Stonehaven,	1	2	...	...	125	145	...	...	8	19
Aberdeen,	8	21	2,527	9,316	9,484	10,846	542	511	...	...
Peterhead,	8¾	24	...	...	1,658½	2,165	...	...	16¾	42
Fraserburgh,	11	30	7½	20	1,194	1,163	2	5	15	24
Banff,	½	2	...	...	91½	97	...	...	...	...
Buckie,	...	...	...	...	1,704	1,571	...	...	...	...
Findhorn,	½	1	...	...	193	210	...	...	...	...
Cromarty,	4	3	...	...	...	...	...	...	...	...
Helmsdale,	½	1	...	...	20¾	27	...	...	...	...
Lybster,	...	...	...	...	25	20	...	...	...	...
Wick,	3	8	...	...	1,940	1,980	...	...	...	...
East Coast Totals carried down,	180½	391	3,494	12,382	17,712¾	20,227	556½	541	130¾	226
Orkney and Shetland.										
Orkney,	...	...	...	...	2,454	1,742	...	...	...	...
Shetland,	...	...	...	...	7,024	3,277	...	...	...	...
Orkney and Shetland Totals carried down,	...	...	...	...	9,478	5,019	...	...	...	...
WEST COAST.										
Stornoway,	185	121	...	...	3,058	1,928	...	...	...	...
Barra,	...	...	...	...	120	58	...	...	...	...
Loch Broom,	13	7	...	...	240	184	...	...	...	...
Loch Carron and Skye,	123	156	...	...	46	60	...	...	23	26
Fort William,	...	...	...	...	42	18	...	...	...	...
Campbeltown,	2	5	...	...	2¼	3	...	...	17½	24
Inveraray,	...	...	...	...	...	...	...	...	1	2
Rothesay,	...	...	...	...	...	...	...	...	...	...
Greenock,	1	3	...	...	...	...	...	...	...	...
Ballantrae,	142	329	...	...	9	17	...	...	71½	223
West Coast Totals carried down,	466	621	...	...	3,517¼	2,268	...	...	113	275
Totals brought down.										
East Coast,	180½	391	3,494	12,382	17,712¾	20,227	556½	541	130¾	226
Orkney and Shetland,	...	...	...	...	9,478	5,019	...	...	...	...
West Coast,	466	621	...	...	3,517¼	2,268	...	...	113	275
Grand Totals for 1893,	646½	1,012	3,494	12,382	30,708	27,514	556½	541	243¾	501
Grand Totals for 1892,	1,010½	1,416	3,588	13,094	25,148¾	26,948	131	221	193½	380½
Increase in 1893,	...	...	...	...	5,559¾	566	425½	320	50¼	120½
Decrease in 1893,	364	404	94	712	...	...	...	...	...	...

continued.

Total Quantity and Value of the different kinds of Fish landed in SCOTLAND compared with 1892.

FISH.												
(LEMON SOLE).		FLOUNDER, PLAICE, BRILL.				TOTAL.				GRAND TOTAL.		
Trawl.		Line.		Trawl.		Line.		Trawl.				
Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	
...	...	139	41	...	...	143¼	52	...	...	143¼	52	
2,887	4,730	4,462	2,784	5,923	5,503	4,880	3,746	9,503	12,372	14,383	16,118	
...	...	2,623	1,598	...	...	3,471	2,709	...	...	3,471	2,709	
1,256	1,706	2,203	1,092	2,986	2,946	2,444	1,451	4,521	5,584	6,965	7,035	
...	...	365	130	...	...	499	296	...	...	499	296	
12,833	21,810	218	185	36,789	36,574	9,710	11,052	52,691	68,211	62,401	79,263	
...	...	382	231	...	...	2,066	2,462	...	...	2,066	2,462	
42	70	107	111	46	47	1,327	1,328	97½	142	1,424½	1,470	
...	...	199	119	...	...	291	218	...	...	291	218	
...	...	4	3	...	...	1,708	1,574	...	...	1,708	1,574	
...	...	2,223	1,208	...	...	2,416⅓	1,419	...	...	2,416⅓	1,419	
...	...	854	473	...	...	858	476	...	...	858	476	
...	...	854	437	...	...	875½	465	...	...	875½	465	
...	...	...	...	...	...	25	20	...	...	25	20	
...	...	1,676	685	...	...	3,619	2,673	...	...	3,619	2,673	
17,018	28,316	16,309	9,097	45,744	45,070	34,333	29,941	66,812½	86,309	101,145½	116,250	
...	...	117	52	...	...	2,571	1,794	...	...	2,571	1,794	
...	...	...	...	...	...	7,024	3,277	...	...	7,024	3,277	
...	...	117	52	...	...	9,595	5,071	...	...	9,595	5,071	
...	...	1,965	731	...	...	5,208	2,780	...	...	5,208	2,780	
...	...	903	326	...	...	1,023	384	...	...	1,023	384	
...	...	226	61	...	...	479	252	...	...	479	252	
...	...	185	87	...	...	377	329	...	...	377	329	
...	...	1,466	650	...	...	1,508	668	...	...	1,508	668	
...	...	1,120½	349	538	525	1,142¼	881	538	525	1,680½	1,406	
...	...	138	142	...	...	139	144	...	...	139	144	
2	3	255	265	74	102	255	265	76	105	331	370	
...	...	357½	346	1,362	1,404	358½	349	1,362	1,404	1,720½	1,753	
4	7	2,509	1,673	2,232	1,431	2,731⅓	2,242	2,236	1,438	4,967½	3,680	
6	10	9,125	5,130	4,206	3,462	13,221¼	8,294	4,212	3,472	17,433¼	11,766	
17,018	28,316	16,309	9,097	45,744	45,070	34,333	29,941	66,812½	86,309	101,145½	116,250	
...	...	117	52	...	...	9,595	5,071	...	...	9,595	5,071	
6	10	9,125	5,130	4,206	3,462	13,221¼	8,294	4,212	3,472	17,433¼	11,766	
17,024	28,326	25,551	14,279	49,950	48,532	57,149¼	43,306	71,024½	89,781	128,173¾	133,087	
23,157	36,774½	26,112	14,513½	44,753	46,934½	52,464¼	43,258	71,629	97,024	124,093¼	140,282	
...	...	...	...	5,197	1,597½	4,685	48	...	...	4,080½	...	
6,133	8,448½	561	234½	...	...	...	...	604½	7,243	...	7,195	

APPENDIX B.—

TOTAL QUANTITY OF FISH LANDED.—STATEMENT, by Districts, of the in the year 1893,

DISTRICTS.	Skate.				Other Kinds of Fish.					
	Line.		Trawl.		Net.		Line.		Trawl.	
EAST COAST.	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
Eyemouth,	23	7	...	...	...	...	974	226	...	...
Leith,	2,869	2,030	3,416	677	1,182	347	6,646	2,113	15,442	3,338
Anstruther,	1,530	362	...	...	329	269	9	2	...	...
Montrose,	469	116	343	83	...	...	1,287	408	1,463	325
Stonehaven,	176	35	...	...	...	...	1,109	139	...	...
Aberdeen,	9,342	1,756	1,593	249	...	...	4,753	1,024	22,457	5,543
Peterhead,	3,129	791	...	...	...	...	2,187	640	...	...
Fraserburgh,	5,598	538	11	3	...	...	3,347	787	56	9
Banff,	512	102	...	...	...	...	81	26	...	...
Buckie,	4,206	591	...	...	...	...	4,888	1,051	...	...
Findhorn,	1,040	308	...	...	...	...	1,189	355	...	...
Cromarty,	25	9	...	...	...	...	1,142	451	...	...
Helmsdale,	68	18	...	...	...	...	62	16	...	...
Lybster,	22	7	...	...	...	...	882	162	...	...
Wick,	4,530	1,563	...	...	...	...	4,637	1,241	...	...
East Coast Totals carried down,	33,539	8,233	5,363	1,012	1,511	616	33,193	8,641	39,418	9,215
Orkney and Shetland.										
Orkney	1,289	239	...	...	1,630	154	42	9	..	...
Shetland,	2,129	216	...	...	...	...	2,931	296	...	...
Orkney and Shetland Totals carried down,	3,418	455	...	...	1,630	154	2,973	305	...	...
WEST COAST.										
Stornoway,	11,616	1,043	...	...	...	...	2,594	382	...	...
Barra,	190	21	...	...	120	12	1,567	144	...	...
Loch Broom,	787	132	...	...	...	...	333	69	...	...
Loch Carron and Skye,	226	48	...	...	...	...	3,302	470	...	...
Fort William,	338	79	...	...	125	37	949	216	...	...
Campbeltown,	724	209	...	...	...	...	533¼	151	...	...
Inveraray,	307	38	...	...	...	...	115	53	...	...
Rothesay,	84	30	...	...	131	72	...	...	...	...
Greenock,	491	177	20	3	...	...	34	30	...	...
Ballantrae,	906	260	...	...	...	...	868	265	...	...
West Coast Totals carried down,	15,669	2,037	20	3	376	121	10,295¼	1,780	...	...
Totals brought down.										
East Coast,	33,539	8,233	5,363	1,012	1,511	616	33,193	8,641	39,418	9,215
Orkney and Shetland,	3,418	455	...	...	1,630	154	2,973	305	...	...
West Coast,	15,669	2,037	20	3	376	121	10,295¼	1,780	...	...
Grand Totals for 1893,	52,626	10,725	5,383	1,015	3,517	891	46,461¼	10,726	39,418	9,215
Grand Totals for 1892,	47,764	10,715½	6,020	1,271½	3,415	760	57,809	13,886½	41,256	9,410½
Increase in 1893,	4,862	9½	...	...	102	131	...	...	...	...
Decrease in 1893,	...	...	637	256½	..	....	11,347¾	3,160½	1,838	195½

continued.

Total Quantity and Value of the different kinds of Fish landed in SCOTLAND compared with 1892.

TOTAL QUANTITY AND VALUE OF FISH LANDED.							
Net.		Line.		Trawl		Total.	
Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
79,622	12,272	28,338½	16,335	...	...	107,960½	28,607
102,822	17,065	72,161	43,291	107,071	59,232	282,054	119,588
106,607	17,337	85,575	34,602	...	...	192,182	51,939
141,560	22,211	85,045	45,695	22,806	13,936	249,411	81,842
54,664	8,311	33,144	13,086	...	...	87,808	21,397
412,934	60,745	133,286	67,833	290,878	201,196	837,098	329,774
703,047½	124,614	80,756	36,204	...	...	783,803½	160,818
907,275	164,247	58,373	26,807	655½	426	966,303½	191,480
85,226	12,691	55,761	27,574	...	...	140,987	40,265
89,598	13,935	61,200	29,899	...	...	150,798	43,834
90,213¼	10,842	37,543¾	19,469	...	...	127,756¾	30,311
19,986	3,384	14,132	6,469	...	...	34,118	9,853
65,018	12,701	10,127¾	3,868	...	...	75,145¾	16,569
26,847	4,416	5,065	1,524	...	...	31,912	5,940
333,157	71,653	51,798	19,613	...	...	384,955	91,266
3,218,576¾	556,474	812,305½	392,269	421,410½	274,790	4,452,292¾	1,223,533
107,102	26,010	43,203	13,579	...	...	150,305	39,589
229,447	43,157	181,816	38,775	...	...	411,263	81,932
336,549	69,167	225,019	52,354	...	...	561,568	121,521
119,115	34,664	126,024	36,144	...	...	245,139	70,808
18,046	8,011	20,759	5,259	...	...	38,805	13,270
131,647	11,396	20,991	5,582	...	...	152,638	16,978
223,615	23,855	14,437	3,634	...	...	238,052	27,489
19,824	2,670	20,529	7,517	...	...	40,353	10,187
248,339	56,231	18,478½	8,531	538	525	267,355½	65,287
143,973	41,494	5,295	2,200	...	...	149,268	43,694
15,373	4,966	3,925	2,908	76	105	19,374	7,979
6,645	3,151	3,644½	2,968	1,408	1,428	11,697½	7,547
8,001½	3,346	21,218½	11,790	2,255	1,467	31,475	16,603
934,578½	189,784	255,301¾	86,533	4,277	3,525	1,194,157¼	279,842
3,218,576¾	556,474	812,305½	392,269	421,410½	274,790	4,452,292¾	1,223,533
336,549	69,167	225,019	52,354	...	...	561,568	121,521
934,578½	189,784	255,301¾	86,533	4,277	3,525	1,194,157¼	279,842
4,489,704¼	815,425	1,292,626½	531,156	425,687½	278,315	6,208,018	1,624,896
3,668,186¼	760,403	1,387,846¾	584,384	380,105	250,768	5,436,138	1,595,555
821,518	55,022	...	...	45,582½	27,547	771,880	29,341
...	...	95,220½	53,228	...	...	...	...

APPENDIX B.—

TOTAL QUANTITY OF FISH LANDED.—STATEMENT, by
landed in SCOTLAND, in the

DISTRICTS.	SHELL					
	Oysters.		Mussels.		Clams.	
EAST COAST.	Hundreds.	£	Cwts.	£	Cwts.	£
Eyemouth,	...	...	...	...	...	...
Leith,	259	150	19,739	1,082	16,879	2,340
Anstruther,	...	...	51,804	3,505	795	45
Montrose,	...	...	43,095	3,327	...	...
Stonehaven,	...	...	129	14	...	...
Aberdeen,	...	...	...	...	...	...
Peterhead,	...	...	4,526	370	...	...
Fraserburgh,	...	...	...	...	...	...
Banff,	...	...	...	...	...	...
Buckie,	...	...	...	...	...	...
Findhorn,	...	...	2,255	169	...	...
Cromarty,	...	...	4,161	318	...	...
Helmsdale,	...	...	1,854	131	...	...
Lybster,	...	...	...	...	...	...
Wick,	...	...	174	19	...	...
East Coast Totals carried down,	259	150	127,737	8,935	17,674	2,385
Orkney and Shetland.						
Orkney,	8	4	...	...	...	...
Shetland,	1	...	3,290	167	...	...
Orkney and Shetland Totals carried down,	9	4	3,290	167	...	...
WEST COAST.						
Stornoway,	10	2	948	74	...	...
Barra,	...	...	44	4	...	...
Loch Broom,	...	...	837	84	...	...
Loch Carron and Skye,	...	...	30	3	...	...
Fort William,	...	...	176	22	...	...
Campbeltown,	13	7	851½	87	...	...
Inveraray,	555	278	1,528	143	10	3
Rothesay,	4	3	6,015	301	...	...
Greenock,	...	...	95,910	3,352	...	...
Ballantrae,	2,307	1,037	2,380	170	...	...
West Coast Totals carried down,	2,889	1,327	108,719½	4,240	10	3
Totals brought down.						
East Coast,	259	150	127,737	8,935	17,674	2,385
Orkney and Shetland,	9	4	3,290	167	...	...
West Coast,	2,889	1,327	108,719½	4,240	10	3
Grand Totals for 1893,	3,157	1,481	239,746½	13,342	17,684	2,388
Grand Totals for 1892,	3,150	1,532	247,186	14,506	20,769	2,736
Increase in 1893,	7	...	...	...	...	...
Decrease in 1893,	...	51	7,439½	1,164	3,085	348

continued.

Districts, of the Total Quantity and Value of the different kinds of Fish Year 1893, compared with 1892.

FISH.							
Lobsters.		Crabs.		Other Kinds.		Total Value.	Grand Total Value of all Fish Landed.
Hundreds.	£	Hundreds.	£	Cwts.	£	£	£
64·68	243	3,819·00	1,863	598	89	2,195	30,802
47·30	209	9,084·00	4,721	4,494	863	9,365	128,953
215·78	638	8,749·00	3,204	945	104	7,496	59,435
91·39	392	3,138·01	1,431	2,004	434	5,584	87,426
17·45	73	1,709·35	894	598	93	1,074	22,471
6·50	28	327·00	296	...	...	324	330,098
32·60	149	50·00	26	193	34	579	161,397
28·60	123	961·00	413	450	55	591	192,071
31·51	156	884·06	527	839	99	782	41,047
5·10	21	358·50	135	414	58	214	44,098
11·00	57	134·50	68	148	21	315	30,626
5·00	18	486·00	142	4,701	610	1,088	10,941
77·50	450	177·00	174	940	95	350	17,419
39·00	192	72·25	38	343	49	279	6,219
709·75	3,373	1,689·00	830	3,682	627	4,849	96,115
1,383·16	6,122	31,638·67	14,762	20,349	3,231	35,585	1,259,118
1,268·50	5,267	178·50	66	3,572	641	5,978	45,567
...	...	...	...	2,862	257	424	82,356
1,268·50	5,267	178·50	66	6,434	898	6,402	127,923
1,366·00	5,917	252·00	103	3,544	403	6,499	77,307
1,074·81	4,005	190·90	76	7,669	1,106	5,191	18,461
535·00	2,114	71·00	19	1,746	321	2,538	19,516
439·42	2,139	177·00	70	6,383	1,294	3,506	30,995
485·00	1,981	10·00	5	6,231	1,153	3,161	13,348
314·22	1,584	48·25	40	4,966½	1,151	2,869	68,156
84·00	385	40·00	40	2,650	584	1,433	45,127
35·00	175	...	...	1,246	329	808	8,787
60·25	292	...	...	1,492	288	3,932	11,479
168·00	555	444·00	188	2,571	1,480	3,430	20,033
4,561·70	19,147	1,233·15	541	38,498½	8,109	33,367	313,209
1,383·16	6,122	31,638·67	14,762	20,349	3,231	35,585	1,259,118
1,268·50	5,267	178·50	66	6,434	898	6,402	127,923
4,561·70	19,147	1,233·15	541	38,498½	8,109	33,367	313,209
7,213·36	30,536	33,050·32	15,369	65,281½	12,238	75,354	1,700,250
7,410·17	32,527	31,179·92	16,710	62,137	12,477	80,488	1,676,043
...	...	1,870·40	...	3,144½	...	...	24,207
196·81	1,991	...	1,341	...	~~239~~	~~5,134~~	...

APPENDIX

FISH USED IN A FRESH STATE.—STATEMENT showing the Total Quantity consumed Fresh in the Localities

DISTRICTS.	Herrings.		Cod.		Ling.	
EAST COAST.	Cwts.	£	Cwts.	£	Cwts.	£
Eyemouth,	28,651	4,432	3,029	1,196	67	41
Leith,	76,509	13,093	43,520	24,277	2,790	1,876
Anstruther,	79,526	12,596	14,201	6,320	2,557	921
Montrose,	7,661	1,598	18,025	6,400	443	227
Stonehaven,	11,537	1,848	8,159	2,381	317	107
Aberdeen,	24,500	5,193	52,018	30,083	15,054	6,086
Peterhead,	31,519	4,207	17,050	6,988	3,733	1,527
Fraserburgh,	23,345	4,293	6,682	2,125	3,349	1,138
Banff,	13,944	2,376	3,343	935	197	71
Buckie,	17,118½	2,690	2,641	1,272	2,284	722
Findhorn,	12,744	1,975	5,529	2,914	718	298
Cromarty,	1,755	312	2,473	974	6	2
Helmsdale,	2,516	615	3,921	1,335	41	21
Lybster,	2,787	655	1,961	685	30	18
Wick,	94,125	23,644	9,124	3,570	5,679	2,348
East Coast Totals carried down,	428,237½	79,527	191,676	91,455	37,265	15,403
Orkney and Shetland.						
Orkney,	11,494	3,147	7,326	2,098	1,127	333
Shetland,	11,525	1,694	480	96	140	30
Orkney and Shetland Totals carried down,	23,019	4,841	7,806	2,194	1,267	363
WEST COAST.						
Stornoway,	25,429	7,260	11,135	2,357	17,958	5,350
Barra,	416	83	119	32	179	56
Loch Broom,	72,831	6,406	5,180	1,342	528	170
Loch Carron and Skye,	134,808	14,578	1,119	355	648	269
Fort William,	2,684	486	2,839	1,306	303	139
Campbeltown,	209,468	48 347	3,439	1,621	288	152
Inveraray,	137,721	39,076	1,046	490	105	46
Rothesay,	13,999	4,379	962	665	43	31
Greenock,	6,422½	2,895	717½	673	183½	155
Ballantrae,	7,196	2,662	9,481	4,190	532	284
West Coast Totals carried down,	610,974½	126,172	36,037½	13,031	20,767½	6,652
Totals brought down.						
East Coast,	428,237½	79,527	191,676	91,455	37,265	15,403
Orkney and Shetland,	23,019	4,841	7,806	2,194	1,267	363
West Coast,	610,974½	126,172	36,037½	13,031	20,767½	6,652
Grand Totals for 1893,	1,062,231	210,540	235,519½	106,680	59,299½	22,418
Grand Totals for 1892,	686,959½	176,792	263,403½	117,786	66,243½	25,200
Increase in 1893,	375,271½	33,748	...	...	...	...
Decrease in 1893,	...	...	27,884	11,106	6,944	2,782

C.—

and Value of White and Shell Fish landed and sold for use in a Fresh State, or where taken, in the Year 1893.

Conger Eel.		Saithe.		Haddock.		Whiting.		Turbot.	
Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
26	19	42	8	22,672	13,642	1,362	1,144	½	1
217	286	2,742	974	81,502	47,455	5,705	3,379	802½	2,363
85	54	430	42	22,037	13,673	1,085	528	8	15
84	48	482	83	73,052	42,841	2,052	1,135	292	966
120	80	276	41	19,857	9,045	1,275	692	1	2
354	251	1,804	812	213,361	131,535	9,841	6,820	2,535	9,337
209	119	1,108	154	38,212	21,046	1,313	420	8½	24
255	135	1,075	253	29,175	18,307	308	141	18½	50
40	25	156	32	44,373	23,648	1,954	979	½	2
29	7	372	45	41,440	23,468	125	25	...	...
18	7	205	49	24,261	13,359	1,499	492	½	1
37	15	39	11	9,365	4,466	187	65	4	3
649½	255	80	11	4,258	1,691	173	56	½	1
78	33	549	85	1,298	434	5	1	...	...
242	171	4,422	808	7,222	2,765	586	132	3	8
2,443½	1,505	13,782	3,408	632,085	367,375	27,470	16,009	3,674	12,773
82	31	1,906	264	6,978	1,907	4	1	...	...
...	...	500	62	23,093	6,735	...	...	...	...
82	31	2,406	326	30,071	8,642	4	1	...	...
4,433	2,017	4,130	450	12,527	4,692	173	60	185	121
1,546	668	70	11	129	34	...	...	...	...
1,338	620	1,072	117	2,168	608	465	126	13	7
709	312	3,845	541	340	143	99	36	123	156
2,672	1,616	2,216	545	119	107	67	73	...	...
427	239	1,416¾	333	1,313½	1,069	1,541	1,332	2	5
254	157	2,000	440	867	552	462	280	...	...
128	66	593	229	1,143	1,014	717	608	...	...
374½	181	222	98	879½	905	410	421	1	3
454	342	696	163	3,141	2,306	2,428	1,767	142	329
12,335½	6,218	16,260¾	2,927	22,627	11,430	6,362	4,703	466	621
2,443½	1,505	13,782	3,408	632,085	367,375	27,470	16,009	3,674	12,773
82	31	2,406	326	30,071	8,642	4	1	...	...
12,335½	6,218	16,260¾	2,927	22,627	11,430	6,362	4,703	466	621
14,861	7,754	32,448¾	6,661	684,783	387,447	33,836	20,713	4,140	13,394
11,618	6,117	41,358	7,256	722,785	394,277	49,102	25,617	4,598½	14,510
3,243	1,637	...	...	...	...	...	...	...	...
...	...	8,909¼	595	38,002	6,830	15,266	4,904	458½	1,116

APPENDIX C.—

FISH USED IN A FRESH STATE.—STATEMENT showing the Total Quantity consumed Fresh in the Localities

DISTRICTS.	Halibut.		Sole (Lemon Sole).		Flounders, Plaice, and Brill.	
EAST COAST.	Cwts.	£	Cwts.	£	Cwts.	£
Eyemouth,	4	10	...	...	139	41
Leith,	291½	708	2,904	4,760	10,385	8,287
Anstruther,	840	1,096	...	...	2,623	1,598
Montrose,	154	214	1,330	1,817	5,189	4,038
Stonehaven,	125	145	8	19	365	130
Aberdeen,	10,026	11,357	12,833	21,810	37,007	36,759
Peterhead,	1,658½	2,165	16¾	42	382	231
Fraserburgh,	1,196	1,168	57	94	153	158
Banff,	91½	97	...	...	199	119
Buckie,	1,704	1,571	...	...	4	3
Findhorn,	193	210	...	...	2,223	1,208
Cromarty,	...	...	...	...	854	473
Helmsdale,	20¾	27	...	...	854	437
Lybster,	25	20	...	...	...	...
Wick,	1,940	1,980	...	...	1,676	685
East Coast Totals carried down,	18,269¼	20,768	17,148¾	28,542	62,053	54,167
Orkney and Shetland.						
Orkney,	2,454	1,742	...	...	117	52
Shetland,	7,024	3,277	...	...	...	...
Orkney and Shetland Totals carried down,	9,478	5,019	...	...	117	52
WEST COAST.						
Stornoway,	3,058	1,928	...	...	1,965	731
Barra,	120	58	...	...	903	326
Loch Broom,	240	184	...	...	226	61
Loch Carron and Skye,	46	60	23	26	185	87
Fort William,	42	18	...	...	1,466	650
Campbeltown,	2¼	3	17½	24	1,658½	1,374
Inveraray,	...	...	1	2	138	142
Rothesay,	...	...	2	3	329	367
Greenock,	...	...	...	...	1,719½	1,750
Ballantrae,	9	17	75½	230	4,741	3,104
West Coast Totals carried down,	3, ¼	2,268	119	285	13,331	8,592
Totals brought down.						
East Coast,	18,269¼	20,768	17,148¾	28,542	62,053	54,167
Orkney and Shetland,	9,478	5,019	...	...	117	52
West Coast,	3,517¼	2,268	119	285	13,331	8,592
Grand Totals for 1893,	31,264½	28,055	17,267¾	28,827	75,501	62,811
Grand Totals for 1892,	25,279¼	27,169	23,350½	37,155	70,865	61,448
Increase in 1893,	5,985¼	886	...	...	4,636	1,363
Decrease in 1893,	...	...	6,082¾	8,328	...	...

—continued.

and Value of White and Shell Fish landed and sold for use in a Fresh State, or where taken, in the year 1893.

Skate.		Other Kinds.		Total.		Shell Fish.	Grand Total Value of Fish Used Fresh.
Cwts.	£	Cwts.	£	Cwts.	£	£	£
23	7	979	229	56,994¼	20,770	2,195	22,965
6,285	2,707	33,834	6,934	267,487	117,099	9,365	126,464
1,530	362	1,513	1,302	126,435	38,507	7,496	46,003
812	199	3,174	849	112,750	60,415	5,584	65,999
176	35	1,109	139	43,325	14,664	1,074	15,738
10,935	2,005	27,734	6,673	418,002	268,721	324	269,045
3,129	791	2,682	718	101,020½	38,432	579	39,011
5,609	541	3,576	817	74,798½	29,220	591	29,811
512	102	81	26	64,891	28,412	782	29,194
4,206	591	4,893	1,053	74,816½	31,447	214	31,661
1,040	308	47,157¼	3,744	95,587¾	24,565	315	24,880
25	9	1,593	488	16,338	6,818	1,088	7,906
68	18	62	16	12,643¾	4,483	850	5,333
22	7	882	162	7,637	2,100	279	2,379
4,530	1,563	4,886	1,309	134,435	38,983	4,849	43,832
38,902	9,245	134,155¼	24,459	1,607,161¼	724,636	35,585	760,221
1,289	239	1,673	163	34,450	9,977	5,978	15,955
2,129	216	3,181	346	48,072	12,456	424	12,880
3,418	455	4,854	509	82,522	22,433	6,402	28,835
11,616	1,043	4,306	736	96,915	26,745	6,499	33,244
190	21	1,900	179	5,572	1,468	5,191	6,659
787	132	347	72	85,195	9,845	2,538	12,383
226	48	3,302	470	145,473	17,081	3,506	20,587
338	79	1,094	268	13,840	5,287	3,161	8,448
724	209	533½	121	220,830¾	54,829	2,869	57,698
307	38	1,323	1,030	144,224	42,253	1,433	43,686
84	30	167	148	18,167	7,540	808	8,348
511	180	256½	286	11,697½	7,547	3,932	11,479
906	260	1,673½	949	31,475	16,603	3,430	20,033
15,689	2,040	14,902½	4,259	773,389¼	189,198	33,367	222,565
38,902	9,245	134,155¼	24,459	1,607,161¼	724,636	35,585	760,221
3,418	455	4,854	509	82,522	22,433	6,402	28,835
15,689	2,040	14,902½	4,259	773,389¼	189,198	33,367	222,565
58,009	11,740	153,911½	29,227	2,463,072½	936,267	75,354	1,011,621
53,784	11,987	114,362½	27,985	2,133,709	933,299	80 488	1,013,787
4,225	...	39,549½	1,242	329,363½	2,968	...	...
...	247	...	...	...	...	5,134	2,166

APPENDIX D.—

FISH CURED.—RETURN, showing the Number of Persons engaged in the Curing of Fish and the Quantities Modes of Cure and the Number and Tonnage

DISTRICTS.	HERRING CURED ON SHORE.								
	Persons engaged in Curing.			Barrels Gutted.	Barrels Ungutted.	Barrels Kippered.	Barrels of Bloaters or Reds.	Barrels Tinned.	Total Number of Barrels.
	Curers.	Coopers, Gutters, Packers, &c.	Total.						
EAST COAST.									
Eyemouth,	50	2,296	2,346	34,727	...	14,945	3,175	...	52,847
Leith,	25	3,031	3,056	972	...	3,119	71	...	4,162
Anstruther,	30	1,741	1,771	3,287	1,080	202	3,577	...	8,146
Montrose,	20	2,752	2,772	57,379	9	148	912	...	58,448
Stonehaven,	16	664	680	16,051	245	477	...	...	16,773
Aberdeen,	52	5,041	5,093	127,934	2,712	7,399	1,905	13,337	153,287
Peterhead,	86	3,599	3,685	259,948	9	18,263	430	673	279,323
Fraserburgh,	87	5,573	5,660	368,611	...	14,522	114	3,854	387,101
Banff,	25	1,020	1,045	25,568	...	1,840	199	...	27,607
Buckie,	24	3,680	3,704	24,475	19	3,320	137	...	27,951
Findhorn,	21	2,210	2,231	11,998	..	5	459	...	12,462
Cromarty,	3	801	804	7,309	...	...	...	...	7,309
Helmsdale,	14	731	745	24,359	...	...	91	...	24,450
Lybster,	13	376	389	8,578	...	583	...	...	9,161
Wick,	124	2,850	2,974	87,033	553	6,995	35	...	94,616
East Coast Totals carried down,	590	36,365	36,955	1,058,229	4,627	71,818	11,105	17,864	1,163,643
Orkney and Shetland.									
Orkney,	44	988	1,032	29,033	2,943	350	100	...	32,426
Shetland,	72	2,805	2,877	90,103	...	1,429	...	...	91,532
Orkney and Shetland Totals carried down,	116	3,793	3,909	119,136	2,943	1,779	100	...	123,958
WEST COAST.									
Stornoway,	122	3,951	4,073	22,156	579	12,748	83	27	35,593
Barra,	49	1,295	1,344	6,152	...	...	...	...	6,152
Loch Broom,	39	985	1,024	10,176	...	...	...	...	10,176
Loch Carron and Skye,	91	796	887	5,541	384	319	...	...	6,244
Fort William,	32	609	641	4,732	429	...	...	...	5,161
Campbeltown,	38	830	868	12,429	1,236¼	698	...	...	14,363¼
Inveraray,	21	265	286	1,423	...	18	...	...	1,441
Rothesay,	8	165	173	177	...	150	18	...	345
Greenock,	31	1,787	1,818	...	...	...	...	...	..
Ballantrae,	27	849	876	...	...	...	...	...	..
West Coast Totals carried down,	458	11,532	11,990	62,786	2,628¼	13,933	101	27	79,475¼
Totals brought down.									
East Coast,	590	36,365	36,955	1,058,229	4 627	71,818	11,105	17,864	1,163,643
Orkney and Shetland,	116	3,793	3,909	119,136	2,943	1,779	100	...	123,958
West Coast,	458	11,532	11,990	62,786	2,628¼	13,933	101	27	79,475¼
Grand Totals for 1893,	1,164	51,690	52,854	1,240,151	10,198¼	87,530	11,306	17,891	1,367,076¼
Grand Totals for 1892,	1,120	50,177	51,297	1,109,421	9,363	94,675	5,183	13,939	1,222,881
Increase in 1893,	44	1,513	1,557	130,730	535¼	2,855	6,123	3,952	144,195¼
Decrease in 1893,	...	...	...	...	...	...	...	...	...

Note.—Of the total number of persons employed, and of barrels of herrings cured, in Eyemouth District, as stated above, 882 persons specified above as engaged in curing includes 23,464 persons who were chiefly employed as

—No. I.

Cured by them, distinguishing between those Cured on Shore and at Sea, and giving the of Vessels fitted out for Curing at Sea.

Herring Cured at Sea.						Total Barrels of Herring Cured on Shore and at Sea.	Total Number and Quantity of Cod, Ling, and Hake Cured.		
Vessels fitted out.			Barrels Gutted.	Barrels Ungutted.	Total Number of Barrels.		Number.	Cwts. Dried.	Barrels Pickled.
Number.	Tonnage.	Men.							
...	...	...	...	...	...	52,847	...	...	...
1	28¾	3	...	...	...	4,162	...	...	...
...	..	...	...	...	...	8,146	324,769	14,644	39
...	...	...	...	...	...	58,448	23,552	724	...
...	...	...	...	...	...	16,773	11,022	421	...
...	...	...	...	...	...	153,287	253,654	11,121	40
...	...	...	...	...	...	279,323	86,677	4,000	...
...	...	...	...	...	...	387,101	63,125	2,525	...
...	...	...	...	...	...	27,607	31,125	1,245	...
...	...	...	...	...	...	27,951	21,740	840	382
...	...	...	...	...	...	12,462	4,414	36	186
...	...	...	...	...	...	7,309	...	...	...
...	...	...	...	...	...	24,450	...	...	...
...	...	...	...	...	...	9,161	1,721	...	81
...	...	...	...	...	...	94,616	69,828	1,642	1,637
1	28¾	3	...	...	...	1,163,643	891,627	37,198	2,365
...	...	...	...	...	...	32,426	477,128	16,026	150
...	...	...	...	...	...	91,532	1,860,304	56,893	...
...	...	...	...	...	...	123,958	2,337,432	72,919	150
...	...	...	4	...	4	35,597	355,613	16,232	893
...	...	...	...	...	...	6,152	136,677	5,683	...
22	799	97	3,257	6,800	10,057	20,233	65,325	2,924	50
48	1,557	169	24,472	7,471	31,943	38,187	28,782	1,166	...
11	194	41	366	...	366	5,527	86,939	3,461	...
...	...	...	84	...	84	14,447½	58,339	2,142½	...
...	...	...	8	...	8	1,449	...	...	...
3	49	9	...	...	...	345	...	...	..
2	69	9	...	...	...	...	...	..	...
...	...	...	...	...	...	...	...	...	...
86	2,668	325	28,191	14,271	42,462	121,937½	731,675	31,608½	943
1	28¾	3	...	...	...	1,163,643	891,627	37,198	2,365
...	...	...	...	...	...	123,958	2,337,432	72,919	150
86	2,668	325	28,191	14,271	42,462	121,937½	731,675	31,608½	943
87	2,696¾	328	28,191	14,271	42,462	1,409,538½	3,960,734	141,725½	3,458
102	3,049½	426	28,330	6,731	35,061	1,257,942	3,605,628	127,645½	6,975
...	...	...	...	7,540	7,401	151,596½	355,106	14,079¾	...
15	352¾	98	139	...	...	...	...	...	3,517

persons and 36,456 barrels are referable to the English section of the district. The total number of vendors of fish, gathering bait, making and mending nets, and manufacturing barrel staves.

APPENDIX D.—No. II.

STATEMENT showing the Number of Barrels of Herrings Cured Gutted, and Ungutted, on the East and West Coasts of Scotland for the Eighty-three years ended 31st December 1893.

Year ended.	*East Coast.			West Coast.			Grand Total.
	Gutted.	Ungutted.	Total.	Gutted.	Ungutted.	Total.	
5th April 1811	2,008¼	6,630	8,638¼	62,186	19,110	81,296	89,934¼
,, 1812	4,325½	10,332	14,657½	65,922	24,518	90,440	105,097½
,, 1813	9,179	20,950½	30,129½	76,561¾	31,025½	107,587¼	137,716¾
,, 1814	9,503	46,800½	56,303½	37,969	5,773	43,742	100,045½
,, 1815	24,314	36,827	61,141	76,021¼	7,756	83,777¼	144,918¼
,, 1816	55,411½	18,416½	73.828	73,292½	2,578¼	75,870¾	149,698¾
,, 1817	90,710½	26,252½	116,963	60,581½	3,233½	63,815	180,778
,, 1818	118,594¾	8,287½	126,882	76,765	4,491½	81,256½	208,138½
,, 1819	221,959¾	22,158	244,117½	75,197¼	6,441	81,638½	325,756
,, 1820	267,556½	27,391¼	294,948	72,629½	4,512	77,141¼	372,089¼
,, 1821	318,473¾	23,909¼	342,382¾	88,626¼	2,613	91,239¼	433,622¼
,, 1822	229,070	12,808¾	241,878¾	56,342½	1,328	57,670¾	299,549¼
,, 1823	183,687	15,256¼	198,943¼	34,211	245½	34,456¾	233,399¾
,, 1824	272,340½	32,402	304,742¼	52,792	802¼	53,594¼	358,336¾
,, 1825	227,667	28,849¾	256,516¾	64,623	593	65,216	321,732¾
,, 1826	289,101	31,703¼	320,804¼	42,602	121	42,723	363,527½
,, 1827	211,042¾	22,241¼	233,284¼	43,231	117	43,348	276,632¼
,, 1828	287,906½	37,882½	325,789	45,632	2,039½	47,671½	373,460½
,, 1829	249,365½	41,047¼	290,412¾	47,525	945	48,470	338,882¾
,, 1830	216,427½	35,226	251,653½	59,494	639	60,133	311,786½
,, 1831	315,479	51,609¾	367,088¾	46,631	855	47,486	414,574¾
,, 1832	259,197½	36,183½	295,381	49,216¼	3,167	52,383¼	347,764¼
,, 1833	267,928½	45,564¾	313,493¼	77,144	573	77,717	391,210¼
,, 1834	315,159	56,374¾	371,533¾	64,427½	137	64,564½	436,098¼
,, 1835	166,539½	33,339½	199,879	45,091½	633	45,724½	245,603½
,, 1836	343,693½	68,891¾	412,585¼	46,554½	479	47,033½	459,618¾
,, 1837	229,371	71,449¼	300,820¼	54,859	1,892½	56,751½	357,571¾
,, 1838	307,625	82,634¾	390,259¾	68,990½	2,374½	71,365	461,624¾
,, 1839	308,581	119,489¾	428,070¾	66,046½	1,672½	67,719	495,789¼
,, 1840	345,074½	103,160	448,234½	54,208½	343	54,551½	502,786
,, 1841	334,539	78,225¼	412,764¼	87,562½	3,402¼	90,965	503,729¼
,, 1842	404,502½	116,675½	521,178	78,755½	2,183½	80,939	602,117
,, 1843	376,374	118,755¾	495,129¾	61,568½	1,627	63,195½	558,325½
,, 1844	384,729	105,927½	490,656¾	81,643	4,776	86,419	577,075½
5th January 1845	305,461½	72,649¼	378,110¾	80,836	901	81,737	459,847¾
,, 1846	343,927	82,607½	426,534½	64,056	3,753½	67,809½	494,344
,, 1847	343,009¾	137,296¾	480,306½	67,613	11,263	78,876	559,182¼
,, 1848	323,471½	135,479	458,950¼	46,636½	9,570	56,206½	515,157
,, 1849	337,450	155,654¼	493,104¼	52,473	6,981	59,454	552,558½
,, 1850	427,138	152,530	579,668	77,171½	25,029¾	102,201¼	681,869¼
,, 1851	320,493	129,532¾	450,025¾	57,694	21,134	78,828	528,853¾
,, 1852	348,573	109,933	458,506	68,660¼	36,220¾	104,881	563,387
31st Dec. 1852	331,055½	89,355	420,410½	44,623½	13,903	58,526½	478,937
,, 1853	482,017	165,459¼	647,476¼	78,350	28,431½	106,781½	754,257¾
,, 1854	410,332	132,977½	543,309½	48,247½	31,207½	79,455	622,764½
,, 1855	505,481¾	136,687½	642,169¼	77,175½	32,631	109,806½	751,975¾
,, 1856	396,650	92,400½	489,050¼	69,755¼	32,492½	102,248	591,298¼
,, 1857	390,775	59,712½	450,487½	74,447½	25,763½	100,211	550,698½
,, 1858	410,524¾	111,440½	521,965¼	59,868½	23,350	83,218½	605,184
,, 1859	308,518¼	55,584	364,102¼	72,541	20,487	93,028	457,130¼
,, 1860	424,201½	103,086¼	527.287¾	71,894	37,891¾	109,785½	637,073¼
,, 1861	447,931½	97,207	545,138½	71,241½	34,336½	105,578	650,716½
,, 1862	536,602½	88,911	625,513½	119,257½	52,685	171,942½	797,456
,, 1863	445,596½	75,511¾	521,108¼	61,396½	26,810	88,206¾	609,314¾
,, 1864	378,752	88,107¾	466,859¾	99,737½	42,889	142,626¾	609,486¼
,, 1865	374,424	73,814¼	448,238½	95,920½	57,207	153,127½	601,366
,, 1866	398,358	72,420¼	470,778¼	99,396½	74,431	173,827½	644,605¾
,, 1867	492,172½	81,978½	574,150¾	139,547¾	90,392	229,939¼	804,090
,, 1868	363,922¾	62,906	426,828¾	81,546	129,886¼	211,432¼	638,260¾
,, 1869	395,500¾	61,809¾	457,310¼	93,330½	124,502¼	217,832¾	675,143

* Including Orkney and Shetland.

APPENDIX D.—No. II.—*continued.*

Year ended.	* East Coast.			West Coast.			Grand Total.
	Gutted.	Ungutted.	Total.	Gutted.	Ungutted.	Total.	
31st Dec. 1870	508,805¼	98,318	607,123¼	148,254	77,783	226,037	833,160¼
,, 1871	585,172	94,178	679,350	83,317½	62,808¼	146,125¾	825,475¾
,, 1872	623,443½	62,341	685,784½	48,260	39,815	88,075	773,859½
,, 1873	710,376½	96,983½	807,360	86,525½	45,348	131,873½	939,233½
,, 1874	789,345½	77,489¾	866,835½	97,657	36,068¾	133,725¾	1,000,561
,, 1875	774,293½	67,729	842,022½	60,529	40,428½	100,957½	942,980
,, 1876	454,164	59,230	513,394	32,074½	52,729	84,803½	598,197½
,, 1877	618,116¾	65,529¼	683,646	98,754½	65,318¼	164,072¾	847,718¾
,, 1878	702,433¾	70,927½	773,361	69,122½	63,284¼	132,407	905,768
,, 1879	563,754	62,833½	626,587½	92,237	122,971¼	215,208¼	841,796
,, 1880	1,096,953½	104,151½	1,201,105	127,245	145,250¾	272,495¼	1,473,600¼
,, 1881	830,751¼	73,602¼	904,353¾	84,346½	122,455	206,801½	1,111,155¼
,, 1882	879,243¾	98,983	978,226½	101,512	203,235	304,747	1,282,973¼
,, 1883	960,428¼	87,477½	1,047,905¾	72,658½	148,848¼	221,506¾	1,269,412½
,, 1884	1,323,989½	132,061¼	1,456,050¾	128,223½	112,803	241,026½	1,697,077¼
,, 1885	1,244,259	74,723¼	1,318,982¼	108,190	145,779¾	253,969¾	1,572,952¼
,, 1886	1,017,152	125,287¾	1,142,439¾	76,211	93,572½	169,783½	1,312,223¼
,, 1887	962,116	127,588	1,089,704	101,937¾	111,782½	213,720¼	1,303,424¼
,, 1888	790,458	82,155¼	872,613¼	116,542	129,717	246,259	1,118,872¼
,, 1889	1,071,686	112,171	1,183,857	105,417	108,233	213,650	1,397,507
,, 1890	1,042,089	81,218¼	1,123,307¼	142,340½	38,955	181,295½	1,304,603
,, 1891	797,219	61,427	858,646	208,024	59,402	267,426	1,126,072
,, 1892	1,012,452	82,267	1,094,719	125,299	37,924	163,223	1,257,942
,, 1893	1,177,365	110,236	1,287,601	90,977	30,960¼	121,937¼	1,409,538¼

* Including Orkney and Shetland.

APPENDIX E.—No. I.

CURED FISH BRANDED.—RETURN showing the Number of Barrels of Cured Herrings Branded, distinguishing the different Brands, and the Amount of Brand Fees Collected, during the year 1893.

DISTRICTS.	NUMBER OF BARRELS OF CURED HERRINGS BRANDED.						Fees Received.
	La. Full.	Full.	Mat. Full	Spent.	Mixed.	TOTAL.	
EAST COAST.							£ s. d.
*Eyemouth,	...	2,469	6,346	823½	1,793	11,431½	190 10 6
Leith,	...	...	...	...	...	...	...
Anstruther,	...	25	38	...	...	63	1 1 0
Montrose,	24	9,068	12,359½	3,264	3,905	28,620½	477 0 2
Stonehaven,	...	4,082	3,082	1,014	448	8,626	143 15 4
Aberdeen,	11	26,926½	11,330	7,728½	879½	46,875½	781 5 2
Peterhead,	432	64,650	14,303½	26,639½	1,893½	107,918½	1,798 12 10
Fraserburgh,	7,077½	84,488	20,891½	23,166½	1,131	136,754½	2,279 4 10
Banff,	...	3,444½	4,466	1,000	1,251	10,161½	169 7 2
Buckie,	...	2,987½	3,664½	1,719	441½	8,812½	146 17 6
Findhorn,	...	3,690½	1,663½	380½	276	6,010½	100 3 6
Cromarty,	...	1,892½	1,794	240½	...	3,927	65 9 0
Helmsdale,	...	8,173	4,164	3,147	111	15,595	259 18 4
Lybster,	...	2 139	1,678½	417	1,555½	5,790	96 10 0
Wick,	...	16,006½	6,895½	9,905½	2,078½	34,886	581 8 8
East Coast Totals carried down,	7,544½	230,042	92,676½	79,445½	15,763½	425,472	7,091 4
Orkney and Shetland.							
Orkney,	...	3,090½	516½	5,281	244	9,132	152 4 0
Shetland,	1,086	2,015½	146½	3,330½	73	6,651½	110 17 2
Orkney and Shetland Totals carried,	1,086	5,106	663	8,611½	317	15,783½	263 1 2
Totals brought down.							
East Coast,	7,544½	230,042	92,676½	79,445½	15,763½	425,472	7,091 4 0
Orkney and Shetland,	1,086	5,106	663	8,611½	317	15,783½	263 1 2
Grand Totals for 1893,	8,630½	235,148	93,339½	88,057	16,080½	441,255½	7,354 5 2
Grand Totals for 1892,	5,972	132,133	128,251½	57,626½	37,142½	361,125½	6,018 15 2
Increase in 1893,	2,658½	103,015	...	30,430½	...	80,130	1,335 10 0
Decrease in 1893	...	...	34,912	...	21,062	...	...

* Of the 11,431½ barrels of herrings branded in the Eyemouth district, 7,228 barrels were branded at the English stations.

APPENDIX E.—No. II.

CURED FISH EXPORTED.—RETURN showing the Total Quantity of Cured Fish Exported to Ireland, to the Continent and to Places out of Europe, during the year 1893.

DISTRICTS.	CURED FISH EXPORTED.									
	NUMBER OF BARRELS OF BRANDED AND UNBRANDED HERRINGS.									
	La. Full.	Full.		Mat. Full.	Spent.	Mixed.	Total Branded.			
	To the Continent.	To the Continent.	To Places out of Europe.	To the Continent.	To the Continent.	To the Continent.	To Ireland.	To the Continent.	To Places out of Europe.	GROSS TOTAL.
EAST COAST.										
*Eyemouth,	...	2,070	...	6,039½	758½	1,852	...	10,720	...	10,720
Leith,	514	15,720	2,218	178	141	15	...	16,568	2218	18,786
Anstruther,	...	...	...	...	...	...	...	...	...	...
Montrose,	24	8,606	...	12,355½	3,265	3,753	...	28,003½	...	28,003½
Stonehaven,	...	837	...	3,126	1,014	448	...	5,425	...	5,425
Aberdeen,	...	24,058½	750	11,254	5,429	627½	...	41,369	750	42,119
Peterhead,	100	42,918	...	13,931½	25,992	1,660	...	84,601½	...	84,601½
Fraserburgh,	5,384	81,049½	...	20,891½	22,939½	1,115	...	131,379½	...	131,379½
Banff,	...	3,443½	...	4,460	1,006	1,249	...	10,158½	...	10,158½
Buckie,	...	1,982	...	3,663½	1,719	273½	...	7,638	...	7,638
Findhorn,	...	3,605½	...	1,630½	381½	276	...	5,893½	...	5,893½
Cromarty,	...	1,890½	...	1,794	240½	...	...	3,925	...	3,925
Helmsdale,	...	8,138	...	4,174	3,126	111	...	15,549	...	15,549
Lybster,	...	1,792	...	1,852	299	727½	...	4,670½	...	4,670½
Wick,	...	14,068½	...	8,047½	9,125	2,315½	...	33,556½	...	33,556½
East Coast Totals carried down,	6,022	210,179	2,968	93,397½	75,436	14,423	...	399,457½	2,968	402,425½
Orkney and Shetland.										
Orkney,	...	3,021½	...	596½	5,268	164	...	9,050	...	9,050
Shetland,	1,082	1,916	...	131½	3,221	72	...	6,422½	...	6,422½
Orkney and Shetland Totals carried,	1,082	4,937½	...	728	8,489	236	...	15,472½	...	15,472½
WEST COAST.										
Stornoway,	...	...	...	...	...	...	...	...	...	...
Barra,	...	...	...	...	...	...	...	...	...	...
Loch Broom,	...	...	...	...	...	...	...	...	...	...
Loch Carron and Skye,	...	...	...	...	...	...	...	...	...	...
Fort William,	...	...	...	...	...	...	...	...	...	...
Campbeltown,	...	...	...	...	...	...	...	...	...	...
Inveraray,	...	...	...	...	...	...	...	...	...	...
Rothesay,	...	...	...	...	...	...	...	...	...	...
Greenock,	...	...	...	...	...	...	...	...	...	...
Ballantrae,	...	...	...	...	...	...	...	...	...	...
West Coast Totals carried down,	...	...	...	...	...	...	...	...	...	...
Totals brought down.										
East Coast,	6,022	210,179	2,968	93,397½	75,436	14,423	...	399,457½	2,968	402,425½
Orkney and Shetland,	1,082	4,937½	...	728	8,489	236	...	15,472½	...	15,472½
West Coast,	...	...	...	...	...	...	...	...	...	...
Grand Totals for 1893,	7,104	215,116½	2,968	94,125½	83,925	14,659	...	414,930	2,968	417,898
Grand Totals for 1892,	5,915	130,861	...	125,802	56,190	34,968½	452	353,736½	...	354,188½
Increase in 1893,	1,189	84,255½	2,968	...	27,735	...	...	61,193½	2,968	63,709½
Decrease in 1893,	...	...	...	31,676½	...	20,309½	452	...	...	...

* Of the 24,017 barrels of herrings exported from Eyemouth district, 15,739 barrels were exported from the English stations.

APPENDIX E.—No. II.—*continued.*

CURED FISH EXPORTED.—RETURN, showing the Total Quantity of Cured Fish Exported to Ireland, to the Continent, and to Places out of Europe, during the Year 1893.

DISTRICTS.	CURED FISH EXPORTED.								
	NUMBER OF BARRELS OF BRANDED AND UNBRANDED HERRINGS—*continued.*					CWTS. OF COD, LING, AND HAKE, DRIED.			
	Unbranded.				Total Branded and Unbranded Exported.	To Ireland.	To the Continent.	To Places out of Europe.	TOTAL.
	To Ireland.	To the Continent.	To Places out of Europe.	GROSS TOTAL.					
EAST COAST.									
*Eyemouth,	4,559	8,738	...	13,297	24,017	...	...	...	...
Leith,	...	63,087½	...	63,087½	81,873½	1,014	24,570	6,079	31,663
Anstruther,	...	1,291	...	1,291	1,291	...	...	...	...
Montrose;	...	16,345½	350	16,695½	44,699	...	...	...	...
Stonehaven,	...	3,856	...	3,856	9,281	...	...	...	...
Aberdeen,	431	54,535½	126	55,092½	97,211½	...	...	3,039	3,039
Peterhead,	...	102,326	...	102,326	186,927½	...	...	...	...
Fraserburgh,	700	162,859½	...	163,559½	294,939	...	...	...	...
Banff,	...	10,551	...	10,551	20,709½	...	...	...	...
Buckie,	...	11,347½	...	11,347½	18,985½	...	...	...	...
Findhorn,	...	3,503½	...	3,503½	9,397	...	...	...	...
Cromarty,	...	1,547½	...	1,547½	5,472½	...	...	...	...
Helmsdale,	...	5,358½	...	5,358½	20,907½	...	...	...	...
Lybster,	...	2,024	...	2,024	6,694½	...	...	...	...
Wick,	3,161	19,810	...	22,971	56,527½	...	...	...	...
East Coast Totals carried down,	8,851	467,181	476	476,508	878,933½	1,014	24,570	9,118	34,702
Orkney and Shetland.									
Orkney,	641	6,801	...	7,442	16,492	3,485	...	...	3,485
Shetland.	...	58,117½	...	58,117½	64,540	14,905	13,094	1,032	29,031
Orkney and Shetland Totals carried,	641	64,918½	...	65,559½	81,032	18,390	13,094	1,032	32,516
WEST COAST.									
Stornoway,	1,245	35,540½	...	36,785½	36,785½	1,124	...	...	1,124
Barra,	...	2,565½	...	2,865½	2,865½	...	...	...	...
Loch Broom,	742	560½	...	1,302½	1,302½	900	...	...	900
Loch Carron and Skye,	1,194	...	...	1,194	1,194	...	...	...	...
Fort William,	370	1,077	...	1,447	1,447	...	...	...	...
Campbeltown,	...	...	...	...	...	1,336½	...	...	1,336½
Inveraray,	...	...	...	...	...	...	...	...	...
Rothesay,	...	...	...	...	...	...	...	...	...
Greenock,	20,388	...	21,238½	41,626½	41,626½	35,889	...	376	36,265
Ballantrae,	...	...	...	...	...	...	...	...	...
West Coast Totals carried down,	23,939	40,043½	21,238½	85,221	85,221	39,249½	...	376	39,625½
Totals brought down.									
East Coast,	8,851	467,181	476	476,508	878,933½	1,014	24,570	9,118	34,702
Orkney and Shetland,	641	64,918½	...	65,559½	81,032	18,390	13,094	1,032	32,516
West Coast,	23,939	40,043½	21,238½	85,221	85,221	39,249½	...	376	39,625½
Grand Totals for 1893,	33,431	572,143	21,714½	627,288½	1,045,186½	58,653½	37,664	10,526	106,843½
Grand Totals for 1892,	27,664	555,944½	23,071½	606,680	960,868½	61,034	49,136	8,214	118,384
Increase in 1893,	5,767	16,198½	...	20,608½	84,318	...	...	2,312	...
Decrease in 1893,	...	...	1,357	...	...	2,380½	11,472	...	11,540½

* Of the 24,017 barrels of herrings exported from Eyemouth district, 15,739 barrels were exported from the English stations.

APPENDIX E.—No. III.

STATEMENT showing the Ports or Places to which the Herrings Exported to the Continent were Shipped.

DISTRICTS.	BARRELS OF HERRINGS EXPORTED.					
	To Russia.					
	Helsingfors.	St Petersburg.	Revel.	Riga.	Libau.	Total.
EAST COAST.						
*Eyemouth,	...	...	...	...	...	...
Leith,	...	9,298½	...	105	18	9,421½
Anstruther,	...	...	...	...	...	...
Montrose,	...	...	...	...	8,539½	8,539½
Stonehaven,	...	...	...	2,386	2,980	5,366
Aberdeen,	...	200	...	...	16,643	16,843
Peterhead,	1,270	...	...	...	49,690	50,960
Fraserburgh,	2,045	750	7,505½	4,703	30,569	45,572½
Banff,	...	...	...	...	...	...
Buckie,	...	...	...	...	800	800
Findhorn,	...	508	...	...	1,326	1,834
Cromarty,	...	...	...	...	...	...
Helmsdale,	...	...	...	...	...	...
Lybster,	...	...	...	...	...	...
Wick,	...	670	...	...	1,160	1,830
East Coast Totals carried down,	3,315	11,426½	7,505½	7,194	111,725½	141,166½
Orkney and Shetland.						
Orkney,	...	...	...	...	...	...
Shetland,	...	4,936½	...	...	...	4,936½
Orkney and Shetland Totals carried,	...	4,936½	...	...	...	4,936½
WEST COAST.						
Stornoway,	...	28,974	...	...	...	28,974
Barra,	...	2,865½	...	...	...	2,865½
Loch Broom,	...	560½	...	...	...	560½
Loch Carron and Skye,	...	...	...	...	...	...
Fort William,	...	...	...	...	...	...
Campbeltown,	...	...	...	...	...	...
Inveraray,	...	...	...	...	...	...
Rothesay,	...	...	...	...	...	...
Greenock,	...	...	...	...	...	...
Ballantrae,	...	...	...	...	...	...
West Coast Totals carried down,	...	32,400	...	...	...	32,400
Totals brought down.						
East Coast,	3,315	11,426½	7,505½	7,194	111,725½	141,166½
Orkney and Shetland,	...	4,936½	...	...	...	4,936½
West Coast,	...	32,400	...	...	...	32,400
Grand Totals for 1893,	3,315	48,763	7,505½	7,194	111,725½	178,503
Grand Totals for 1892,	3,511	41,443½	5,685	12,017½	106,782	169,439
Increase in 1893,	...	7,319½	1,820½	...	4,943½	9,064
Decrease in 1893,	196	...	...	4,823½	...	...

* Of the 19,458 barrels exported to the Continent from Eyemouth district, 11,180 barrels were exported from the English stations.

APPENDIX E.—

STATEMENT showing the Ports or Places to which the Herrings

DISTRICTS.	BARRELS OF					
	TO GERMANY.					
	Port Baltic.	Memel.	Königsberg.	Elbing.	Danzig.	Stettin.
EAST COAST.						
*Eyemouth,	...	...	3,455½	...	4,433	10,441
Leith,	...	...	954½	...	1,128	18,751½
Anstruther,	...	...	...	...	1,291	...
Montrose,	...	...	9,550½	...	11,229	15,030
Stonehaven,	...	...	2,353	...	920	642
Aberdeen,	...	...	19,177½	...	12,959½	26,303
Peterhead,	...	...	55,242½	...	19,807	44,891
Fraserburgh,	4,694	4,108½	45,359½	615	26,788½	101,051
Banff,	...	...	2,531½	...	9,232	8,946
Buckie,	...	...	3,926½	...	3,322	10,937
Findhorn,	...	...	1,087	...	2,354½	4,121½
Cromarty,	...	...	472½	...	...	5,000
Helmsdale,	...	...	2,322	...	856	17,729½
Lybster,	...	...	...	...	3,447	2,817
Wick,	...	802	6,180½	...	14,191½	29,317½
East Coast Totals carried down,	4,694	4,910½	152,613	615	111,959	295,978
Orkney and Shetland.						
Orkney,	...	...	...	...	4,731	11,120
Shetland,	...	...	2,975½	...	...	52,556½
Orkney and Shetland Totals carried down,	...	...	2,975½	...	4,731	63,676½
WEST COAST.						
Stornoway,	...	...	4,142½	...	...	2,424
Barra,	...	...	...	...	...	...
Loch Broom,	...	...	...	...	...	...
Loch Carron and Skye,	...	...	...	...	...	...
Fort William,	...	...	1,077	...	...	...
Campbeltown,	...	...	...	...	...	...
Inverary,	...	...	...	...	...	...
Rothesay,	...	...	...	...	...	...
Greenock,	...	...	...	...	...	...
Ballantrae,	...	...	...	...	...	...
West Coast Totals carried down,	...	...	5,219½	...	...	2,424
Totals brought down.						
East Coast,	4,694	4,910½	152,613	615	111,959	295,978
Orkney and Shetland,	...	...	2,975½	...	4,731	63,676½
West Coast,	...	...	5,219½	...	...	2,424
Grand Totals for 1893,	4,694	4,910½	160,808	615	116,690	362,078½
Grand Totals for 1892,	4,403	4,077½	148,012½	660	99,541½	332,127
Increase in 1893,	291	833	12,795½	...	17,148½	29,951½
Decrease in 1893,	...	...	...	45	...	...

* Of the 19,458 barrels exported to the Continent from Eyemouth district,

No. III.—*continued.*

Exported to the Continent were Shipped.

HERRINGS EXPORTED.								
To Germany.			To Holland.					Total Exported to the Continent.
Hamburg.	Bremen.	Total.	Bremerhaven.	Rotterdam.	Amsterdam.	Antwerp.	Total.	
1,128½	...	19,458	...	...	...	..	...	19,458
47,938½	205	68,977½	403	746	...	107½	1,256½	79,655½
...	...	1,291	...	...	...	...	...	1,291
...	...	35,809½	...	...	...	...	...	44,349
...	...	3,915	...	...	...	...	...	9,281
20,481½	...	78,921½	...	140	...	...	140	95,904½
16,027	...	135,967½	...	...	...	...	...	186,927½
66,050	...	248,666½	...	...	...	...	...	294,239
...	...	20,709½	...	...	...	...	...	20,709½
...	...	18,185½	...	...	...	...	...	18,985½
...	...	7,563	...	...	...	...	...	9,397
...	...	5,472½	...	...	...	...	...	5,472½
...	...	20,907½	...	...	...	...	...	20,907½
430½	...	6,694½	...	...	...	...	...	6,694½
1,045	...	51,536½	...	...	...	...	...	53,366½
153,101	205	724,075½	403	886	...	107½	1,396½	866,638½
...	...	15,851	...	...	...	...	...	15,851
4,071½	...	59,603½	...	...	...	...	...	64,540
4,071½	...	75,454½	...	...	...	...	...	80,391
...	...	6,566½	...	...	...	...	...	35,540½
...	...	...	...	...	...	...	...	2,865½
...	...	...	...	...	...	...	...	560½
...	...	...	...	...	...	...	...	...
...	...	1,077	...	...	...	...	...	1,077
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	7,643½	...	...	...	...	...	40,043½
153,101	205	724,075½	403	886	...	107½	1,396½	866,638½
4,071½	...	75,454½	...	...	...	...	...	80,391
...	...	7,643½	...	...	...	...	...	40,043½
157,172½	205	807,173½	403	886	...	107½	1,396½	987,073
150,245	305	739,371½	15	811	34½	10	870½	909,681
6,927½	...	67,802	388	75	...	97½	526	77,392
...	100	...	...	...	34½	...	...	...

11,180 barrels were exported from the English stations.

APPENDIX E.—

VALUE OF CURED FISH—RETURN showing the estimated Value during the

DISTRICTS.	VALUE OF CURED HERRINGS BRANDED.					
	La. Full.	Full.	Mat. Full.	Spent.	Mixed.	Total Branded.
EAST COAST.	£	£	£	£	£	£
*Eyemouth,	...	2,469	5,713	534	1,160	9,876
Leith,	...	...	...	...	...	...
Anstruther,	...	28	37	...	...	65
Montrose,	36	9,748	11,445	2,454	2,733	26,416
Stonehaven,	...	4,286	2,735	634	280	7,935
Aberdeen,	13	28,945	10,763	5,216	594	45,531
Peterhead,	583	69,639	12,752	17,981	1,283	102,238
Fraserburgh,	8,847	92,937	18,897	16,795	791	138,267
Banff,	...	3,704	4,154	675	813	9,346
Buckie,	...	3,137	3,298	1,160	298	7,893
Findhorn,	...	3,779	1,501	247	179	5,706
Cromarty,	...	2,264	1,968	191	...	4,423
Helmsdale,	...	8,581	3,748	2,046	66	14,441
Lybster,	...	1,882	1,667	209	473	4,231
Wick,	...	16,807	6,206	6,934	1,351	31,298
East Coast Totals carried down,	9,479	248,206	84,884	55,076	10,021	407,666
Orkney and Shetland.						
Orkney,	...	3,245	348	3,564	153	7,310
Shetland,	1,419	2,222	132	2,332	51	6,156
Orkney and Shetland Totals carried down,	1,419	5,467	480	5,896	204	13,466
WEST COAST.						
Stornoway,	...	...	...	...	...	...
Barra,	...	...	...	...	...	...
Loch Broom,	...	...	...	...	...	...
Loch Carron and Skye,	...	...	...	...	...	...
Fort William,	...	...	...	...	...	...
Campbeltown,	...	...	...	...	...	...
Inveraray,	...	...	...	...	...	...
Rothesay,	...	...	...	...	...	...
Greenock,	...	...	...	...	...	...
Ballantrae,	...	...	...	...	...	...
West Coast Totals carried down,	...	...	...	...	...	...
Totals brought down.						
East Coast,	9,479	248,206	84,884	55,076	10,021	407,666
Orkney and Shetland,	1,419	5,467	480	5,896	204	13,466
West Coast,	...	...	...	...	...	...
Grand Totals,	10,898	253,673	85,364	60,972	10,225	421,132

* Of the value of herrings cured in the Eyemouth district, that of

Note.—In addition to the above values of cured fish, the estimated value of

No. IV.

of Cured Herrings, Branded and Unbranded, as well as of Cured Cod, &c., Year 1893.

Value of Cured Herrings Unbranded.	Grand Total Value of Cured Herrings.	VALUE OF CURED COD, LING, &c.			Grand Total Value of Cured Fish.	DISTRICTS.
		Dried.	Pickled.	Total.		
£	£	£	£	£	£	**EAST COAST.**
31,025	40,901	...	...	...	40,901	Eyemouth.
2,678	2,678	...	...	...	2,678	Leith.
6,243	6,308	11,185	78	11,263	17,571	Anstruther.
13,809	40,225	716	...	716	40,941	Montrose.
3,857	11,792	372	...	372	12,164	Stonehaven.
40,156	85,687	8,378	120	8,498	94,185	Aberdeen.
89,947	192,185	3,780	...	3,780	195,965	Peterhead.
153,023	291,290	2,236	...	2,236	293,526	Fraserburgh.
9,233	18,579	935	...	935	19,514	Banff.
10,213	18,106	756	955	1,711	19,817	Buckie.
3,528	9,234	36	390	426	9,660	Findhorn.
1,155	5,578	...	...	...	5,578	Cromarty.
3,215	17,656	...	...	...	17,656	Helmsdale.
1,619	5,850	...	162	162	6,012	Lybster.
27,133	58,431	1,642	3,274	4,916	63,347	Wick.
396,834	804,500	30,036	4,979	35,015	839,515	East Coast Totals carried down.
						Orkney and Shetland.
30,000	37,310	11,214	247	11,461	48,771	Orkney.
72,273	78,429	39,375	...	39,375	117,804	Shetland.
102,273	115,739	50,589	247	50,836	166,575	Orkney and Shetland Totals carried down.
						WEST COAST.
84,896	84,896	15,817	770	16,587	101,483	Stornoway.
18,844	18,844	5,320	...	5,320	24,164	Barra.
13,530	13,530	2,339	75	2,414	15,944	Loch Broom.
29,417	29,417	940	...	940	30,357	Loch Carron and Skye.
5,711	5,711	2,872	...	2,872	8,583	Fort William.
10,378	10,378	849	...	849	11,227	Campbeltown.
1,441	1,441	...	...	...	1,441	Inveraray.
589	589	...	...	...	589	Rothesay.
...	...	...	...	...	...	Greenock.
...	...	...	...	...	...	Ballantrae.
164,806	164,806	28,137	845	28,982	193,788	West Coast Totals carried down.
						Totals brought down.
396,834	804,500	30,036	4,979	35,015	839,515	East Coast.
102,273	115,739	50,589	247	50,836	166,575	Orkney and Shetland.
164,806	164,806	28,137	845	28,982	193,788	West Coast.
663,913	1,085,045	108,762	6,071	114,833	1,199,878	Grand Totals.

those cured at the English stations thereof amounted to £23,137.
haddocks cured smoked at the Scottish stations was £267,615.

APPEN

RETURN of the Tonnage of Shipping, and of the Number of Seamen engaged in the Trade employed in Importing Stave Wood and Hoops; in Importing Salt; in Carrying Herrings Foreign Tonnage and Men.

DISTRICTS.	TONNAGE											
	Importing Stave Wood and Hoops.				Importing Salt.				Carrying Herrings or Cod Fish Coastwise.			
	British.		Foreign.		British.		Foreign.		British.		Foreign.	
	Tons.	Men.	Tons.	Men.	Tons.	Men.	Tons.	Men.	Tons.	Men.	Tons.	Men.
Eyemouth,	57	4	260	19	1,334	89	...	...	885	52	...	...
Leith,	440	26	240	12	286	14	...	...	600	36	...	...
Anstruther,	87	5	443	27	422	26	...	...	...	...	...	...
Montrose,	76	5	791	42	1,300	84	...	...	394	20	...	...
Stonehaven,	80	6	63	4	389	18	...	...	312	34	...	...
Aberdeen,	4,010	236	440	23	3,144	186	110	6	2,100	130	143	9
Peterhead,	819	49	5,232	313	5,654	335	1,219	72	1,863	126	...	...
Fraserburgh,	758	36	4,324	211	6,875	427	972	52	424	37	...	...
Banff,	113	12	...	...	919	54	...	...	94	16	...	...
Buckie,	214	19	366	23	603	35	...	...	...	...	...	...
Findhorn,	60	5	...	...	325	16	...	...	70	5	...	...
Cromarty,	...	...	...	...	474	16	50	3	90	8	...	...
Helmsdale,	...	...	214	10	446	22	178	7	20	2	...	...
Lybster,	112	6	...	...	312	15	...	...	25	3	...	...
Wick,	875	61	447	29	3,162	206	480	29	2,661	163	...	...
Orkney,	...	...	134	9	1,823	116	...	...	3,451	282	334	12
Shetland,	300	15	450	22	1,610	84	143	7	5,020	251	...	...
Stornoway,	151	15	877	44	2,470	135	545	25	4,450	230	...	...
Barra,	...	...	...	...	126	7	...	...	2,102	128	...	...
Loch Broom,	...	...	...	...	1,335	115	...	...	2,720	239	...	...
Loch Carron and Skye,	...	...	...	...	1,210	74	...	...	10,315	815	...	...
Fort William,	...	...	...	...	456	33	...	...	714	44	...	...
Campbeltown,	...	...	...	...	207	10	...	...	5,581	417	...	...
Inveraray,	...	...	...	...	160	12	...	...	900	98	...	...
Rothesay,	...	...	...	...	80	5	...	...	285	34	...	...
Greenock,	60	5	...	...	900	45	...	...	842	58	...	...
Ballantrae,	...	...	...	...	...	...	...	...	...	...	...	...
Grand Totals for 1893,	8,212	505	14,281	788	36,022	2,179	3,697	201	45,918	3,228	477	21
Grand Totals for 1892,	10,175	601	10,624	532	36,356	2,071	4,030	193	41,020	2,666	...	...
Increase in 1893,	...	...	3,657	256	...	108	...	8	4,898	562	477	21
Decrease in 1893,	1,963	96	...	...	334	...	333	...	...	...	...	...

Note.—The tonnage and men of Eyemouth district, as given above, include

DIX F.

of the Herring and Cod and Ling Fisheries in the year 1893; distinguishing those or Cod Fish Coastwise, and in Exporting them abroad; and separating British from

AND MEN.								GRAND TOTAL.	
Exporting Herrings or Cod Fish.				Total.					
British.		Foreign.		British.		Foreign.		British and Foreign.	British and Foreign.
Tons.	Men.	Tons	Men.	Tons.	Men.	Tons.	Men.	Tons.	Men.
1,093	69	1,292	70	3,369	214	1,552	89	4,921	303
13,280	794	...	...	14,606	870	240	12	14,846	882
62	4	74	4	571	35	517	31	1,088	66
1,143	58	3,157	143	2,913	167	3,948	185	6,861	352
99	6	887	50	880	64	950	54	1,830	118
5,105	200	4,667	220	14,359	752	5,360	258	19,719	1,010
5,413	226	11,906	592	13,749	736	18,357	977	32,106	1,713
12,059	561	15,555	752	20,116	1,061	20,851	1,015	40,967	2,076
1,737	100	268	11	2,863	182	268	11	3,131	193
797	49	1,297	60	1,614	103	1,663	83	3,277	186
751	40	168	9	1,206	66	168	9	1,374	75
...	...	146	8	564	24	196	11	760	35
1,467	74	947	44	1,933	98	1,339	61	3,272	159
441	27	193	10	890	51	193	10	1,083	61
2,440	127	2,561	120	9,138	557	3,488	178	12,626	735
1,273	78	642	36	6,547	476	1,110	57	7,657	533
3,680	189	3,813	183	10,610	539	4,406	212	15,016	751
1,342	73	2,591	133	8,413	453	4,013	202	12,426	655
...	...	...	...	2,228	135	...	...	2,228	135
272	34	...	...	4,327	388	...	...	4,327	388
151	16	...	...	11,676	905	...	...	11,676	905
132	20	...	...	1,302	97	...	...	1,302	97
145	60	...	...	5,933	487	...	...	5,933	487
...	...	...	...	1,060	110	...	...	1,060	110
...	...	...	...	365	39	...	...	365	39
7,760	456	...	...	9,562	564	...	...	9,562	564
...	...	...	...	...	...	...	...	...	...
60,642	3,261	50,164	2,445	150,794	9,173	68,619	3,455	219,413	12,628
61,696	3,490	45,507	2,233	149,247	8,828	60,161	2,958	209,408	11,786
...	...	4,657	212	1,547	345	8,458	497	0,005	842
1,054	229	...	...	...	...	...	...	...	...

257 tons and 200 men employed in the English section of the district.

APPENDIX G.—

RETURN for the Year 1893, showing the Number and Value of Fishing Boats and Trawlers and Sailing Vessels into

DISTRICTS.	Fishing Boats.											
	Propelled by Steam.		Propelled by Sails.								Total.	
			1st Class.		2nd Class.		3rd Class.		Total.			
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
		£		£		£		£		£		£
Eyemouth,	.	.	2	760	3	141	1	12	6	913	6	913
Leith,	3	2,400	1	330	22	1,040	.	.	23	1,370	26	3,770
Anstruther,	7	14,900	.	.	6	186	.	.	6	186	13	15,086
Montrose,	.	.	6	960	1	36	2	34	9	1,030	9	1,030
Stonehaven,	.	.	2	173	2	65	.	.	4	238	4	238
Aberdeen,	.	.	5	450	.	.	.	.	5	450	5	450
Peterhead,	2	6,000	10	2,300	.	.	1	15	11	2,315	13	8,315
Fraserburgh,	.	.	22	7,950	16	450	.	.	38	8,400	38	8,400
Banff,	.	.	15	5,460	8	280	7	120	30	5,860	30	5,860
Buckie,	.	.	17	7,140	2	65	.	.	19	7,205	19	7,205
Findhorn,	.	.	21	8,350	.	.	.	.	21	8,350	21	8,350
Cromarty,	.	.	.	.	.	.	12	168	12	168	12	168
Helmsdale,	.	.	.	.	.	.	.	.	.	.	.	.
Lybster,	.	.	.	.	.	.	.	.	.	.	.	.
Wick,	.	.	1	280	.	.	4	60	5	340	5	340
Orkney,	.	.	.	.	5	150	8	64	13	214	13	214
Shetland,	.	.	.	.	6	150	60	360	66	510	66	510
Stornoway,	.	.	1	100	13	372	.	.	14	472	14	472
Barra,	.	.	.	.	.	.	.	.	.	.	.	.
Loch Broom,	.	.	.	.	.	.	.	.	.	.	.	.
Loch Carron and Skye,	.	.	.	.	2	120	7	85	9	205	9	205
Fort William,	.	.	.	.	4	32	2	12	6	44	6	44
Campbeltown,	.	.	.	.	2	139	.	.	2	139	2	139
Inveraray,	.	.	.	.	3	270	.	.	3	270	3	270
Rothesay,	.	.	.	.	11	925	.	.	11	925	11	925
Greenock,	.	.	.	.	.	.	.	.	.	.	.	.
Ballantrae,	.	.	.	.	6	153	.	.	6	153	6	153
Totals,	12	23,300	103	34,253	112	4,574	104	930	319	39,757	331	63,057

No. I.

constructed within the boundaries of each District, distinguishing Steam and Sailing Vessels First, Second, and Third Class.

Trawlers.						Total Fishing Boats and Trawlers.						Remarks.
Propelled by Steam.		Propelled by Sails.		Total.		Propelled by Steam.		Propelled by Sails.		Total.		
No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	
	£		£		£		£		£		£	
.	.	.	.	.	.	.	.	6	913	6	913	1 boat, value £400, for another district in Scotland.
3	15,000	.	.	3	15,000	6	17,400	23	1,370	29	18,770	
.	.	.	.	.	.	7	14,900	6	186	13	15,086	
.	.	.	.	.	.	.	.	9	1,030	9	1,030	2 boats, value £196, for other districts in Scotland.
.	.	.	.	.	.	.	.	4	238	4	238	
3	12,700	.	.	3	12,700	3	12,700	5	450	8	13,150	1 trawler, value £4,500, for use out of Scotland; and 2 boats, value £180, for use in Scotland.
.	.	.	.	.	.	2	6,000	11	2,315	13	8,315	1 steam liner, value £3,000, for use at Aberdeen.
.	.	.	.	.	.	.	.	38	8,400	38	8,400	
.	.	.	.	.	.	.	.	30	5,860	30	5,860	4 boats, value £1,520, for other districts in Scotland.
.	.	.	.	.	.	.	.	19	7,205	19	7,205	
.	.	.	.	.	.	.	.	21	8,350	21	8,350	11 boats, value £4,370, for other districts in Scotland.
.	.	.	.	.	.	.	.	12	168	12	168	
.	.	.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	5	340	5	340	
.	.	.	.	.	.	.	.	13	214	13	214	
.	.	.	.	.	.	.	.	66	510	66	510	
.	.	.	.	.	.	.	.	14	472	14	472	
.	.	.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	9	205	9	205	
.	.	.	.	.	.	.	.	6	44	6	44	
.	.	.	.	.	.	.	.	2	139	2	139	
.	.	.	.	.	.	.	.	3	270	3	270	
.	.	.	.	.	.	.	.	11	925	11	925	9 boats, value £756, for other districts in Scotland.
13	52,000	.	.	13	52,000	13	52,000	.	.	13	52,000	13 trawlers, value £52,000, for Hull and Grimsby owners.
.	.	2	140	2	140	.	.	8	293	8	293	
19	79,700	2	140	21	79,840	31	103,000	321	39,897	352	142,897	

APPENDIX G.—

RETURN, for the Year 1893, of the Number of Barrels and the Number of Half-kinds of Wood used and the methods of Hooping adopted, with remarks as to they were made, or outside Scotland, and of the Number of Quarter Cran

DISTRICTS.	BARRELS AND HALF-				
		Of Ash, Elm, Birch, Alder, &c.	Of Larch.	Of Fir.	Total.
* Eyemouth,	Barrels	21,045	400	7,935	29,380
	½ Barrels	670	30	523	1,223
Leith,	Barrels	3,452	.	400	3,852
	½ Barrels	3,960	.	.	3,960
Anstruther,	Barrels	34,600	.	5,410	40,010
	½ Barrels	450	.	.	450
Montrose,	Barrels	6,919	.	32,822	39,741
	½ Barrels	490	.	689	1,179
Stonehaven,	Barrels	.	456	12,150	12,606
	½ Barrels	.	.	200	200
Aberdeen,	Barrels	69,703	3,602	14,638	87,943
	½ Barrels	1,300	450	9,003	10,753
Peterhead,	Barrels	5,400	.	186,200	191,600
	½ Barrels	.	.	4,000	4,000
Fraserburgh,	Barrels	62,000	27,000	207,000	296,000
	½ Barrels	.	3,000	9,000	12,000
Banff,	Barrels	.	400	32,400	32,800
	½ Barrels	.	800	600	1,400
Buckie,	Barrels	.	.	39,050	39,050
	½ Barrels	.	.	8,860	8,860
Findhorn,	Barrels	.	2,280	26,711	28,991
	½ Barrels	.	2,020	5,516	7,536
Cromarty,	Barrels	.	600	4,650	5,250
	½ Barrels	.	90	.	90
Helmsdale,	Barrels	2,250	3,000	22,675	27,925
	½ Barrels	.	850	631	1,481
Lybster,	Barrels	950	.	800	1,750
	½ Barrels	200	.	450	650
Wick,	Barrels	60,252	1,126	26,118	87,496
	½ Barrels	4,012	.	16,543	20,555
Orkney,	Barrels	9,092	.	.	9,092
	½ Barrels	321	.	245	566
Shetland,	Barrels	.	.	17,600	17,600
	½ Barrels	.	.	1,850	1,850
Stornoway,	Barrels	7,084	.	19,786	26,870
	½ Barrels	3,004	.	18,291	21,295
Barra,	Barrels	.	.	.	.
	½ Barrels	.	.	.	.
Loch Broom,	Barrels	.	.	400	400
	½ Barrels	.	.	.	.
Loch Carron and Skye,	Barrels	.	.	.	.
	½ Barrels	.	.	.	.
Fort William,	Barrels	.	.	.	.
	½ Barrels	.	.	.	.
Campbeltown,	Barrels	.	.	.	.
	½ Barrels	.	.	.	.
Inveraray,	Barrels	.	.	.	.
	½ Barrels	.	.	.	.
Rothesay,	Barrels	.	.	.	.
	½ Barrels	.	.	.	.
Greenock,	Barrels	390	.	880	1,270
	½ Barrels	.	.	2,390	2,390
Ballantrae,	Barrels	.	.	.	.
	½ Barrels	.	.	.	.
Totals,	Barrels	283,137	38,864	657,625	979,626
	½ Barrels	14,407	7,240	78,791	100,438

* Of the number of barrels and half-barrels constructed in the Eyemouth district, 19,015
Coast. About 6,350 of the barrels, included above, were sent from Scotland to

No. II.

Barrels constructed within the boundaries of each District, showing the different the Number of Barrels and Half-Barrels (if any) used outside the Districts in which Basket Measures Branded.

BARRELS CONSTRUCTED.			Number of ½ cran basket measures branded.	REMARKS.
Hooped entirely with Wood.	Hooped entirely with Iron.	Hooped partly with Wood and partly with Iron.		
200	.	29,180	50	Of the total number of barrels constructed, 1,500 were intended for use at Yarmouth.
350	.	873		
240	.	3,612	7,215	
.	.	3,960		
.	.	40,010	.	About 6,000 barrels were sent to Ireland; 2,500 barrels to England; 27,500 barrels and 450 half-barrels to other districts in Scotland.
.	.	450		
.	.	39,741	1,909	
.	.	1,179		
.	.	12,606		
200	.	.	.	
.	92	87,851	3,643	
488	.	10,265		
.	.	191,600	1,619	About 8,500 barrels were sent to stations at Orkney and Shetland and West Coast stations.
.	.	4,000		
.	.	296,000	620	About 32,000 barrels were dispatched to other districts in Scotland, and fully the same quantity afterwards imported.
.	.	12,000		
800	.	32,000	.	About 2,000 of these barrels were sent out of Scotland, and 3,000 barrels outside the district in Scotland.
100	.	1,300		
.	.	39,050	51	About 8,000 barrels and 6,500 half-barrels were sent to other districts in Scotland.
.	.	8,860		
.	.	28,991	.	About 21,743 barrels were sent out of the district in Scotland, and 2,300 barrels sent to Ireland.
.	.	7,536		
.	.	5,250	.	
.	.	90		
2,972	.	24,953	.	About 6,350 barrels and 50 half-barrels were sent to other districts in Scotland.
25	.	1,456		
200	.	1,550	.	
.	.	650		
2,758	.	84,738	3,353	About 40,000 barrels were sent to other stations in Scotland, and probably 1,350 barrels to Ireland and England.
.	.	20,555		
3,679	.	5,473	.	
368	.	198		
.	.	17,600	.	
.	.	1,850		
.	.	26,870	65	
.	.	21,295		
.	.	.	.	
.	.	.		
.	.	400	.	
.	.	.		
.	.	.	.	
.	.	.		
.	.	.	.	
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.	.	.	.	
.	.	.		
.	.	.	.	
.	.	.		
.	.	.	.	
.	.	.		
.	.	1,270	740	1,270 barrels made for use in other districts in Scotland.
2,390	.	.		
.	.	.	.	
.	.	.		
10,849	92	968,685	19,265	
3,921	.	96,517		

barrels and 565 half-barrels were made in the English section of the district, on the Northumberland English stations south of Northumberland, and 9,300 barrels sent to Irish stations.

APPENDIX H.

RETURN of the Number of Lives Lost in connection with the Fisheries, and the manner in which the Casualties happened; the Number of Boats totally wrecked, and Value thereof; the Number of Boats damaged, and Amount of Damage; and the Loss on Nets and other Fishing Material, lost or damaged, in the Year 1893.

DISTRICTS.	Lives Lost.							Boats Totally Wrecked, and Value thereof.		Boats Damaged, and Amount of Damage.		Loss on Boats Totally Wrecked or Damaged.	Loss on Nets and other Fishing Material, Lost or Damaged.	Total Loss on Boats, Nets, &c., Lost or Damaged.
	Through foundering at Sea.	In taking Harbour.	In Collisions.	Washed Overboard.	Falling Overboard.	Knocked Overboard or Killed by Sail, &c.	Total.	Number.	Value.	Number.	Amount of Damage.			
Eyemouth,	2	...	...	...	1	...	3	...	...	4	£13	£13	£430	£443
Leith,	...	...	1	1	...	...	2	2	£2,040	1	150	2,190	8,540	10,730
Anstruther,	3	...	...	...	1	1	5	2	152	15	135	287	1,071	1,358
Montrose,	...	1	...	...	1	...	2	1	6	9	178	184	736	920
Stonehaven,	...	...	...	...	...	...	...	...	...	13	47	47	339	386
Aberdeen,	14	...	...	1	1	1	17	5	7,975	13	3,202	11,177	10,782	21,959
Peterhead,	...	...	...	...	2	...	2	3	200	11	54	254	5,306	5,560
Fraserburgh,	...	...	...	...	2	3	5	2	228	33	266	494	5,998	6,492
Banff,	...	...	...	...	...	...	...	4	130	11	76	206	458	664
Buckie,	27	...	...	3	1	...	31	7	1,352	7	145	1,497	3,580	5,077
Findhorn,	...	...	...	...	1	...	1	5	152	5	62	214	1,049	1,263
Cromarty,	...	...	...	...	...	1	1	...	...	1	3	3	150	153
Helmsdale,	...	...	...	...	...	...	...	...	...	1	10	10	306	316
Lybster,	...	...	...	...	...	...	...	...	...	3	30	30	230	260
Wick,	16	...	...	...	1	1	18	1	200	9	1,665	1,865	1,548	3,413
Orkney,	...	...	...	...	...	...	...	...	...	2	20	20	70	90
Shetland,	...	...	...	...	1	...	1	...	...	1	5	5	55	60
Stornoway,	12	...	...	1	1	...	14	10	220	16	270	490	456	946
Barra,	...	...	...	...	...	...	...	...	...	9	63	63	581	644
Loch Broom,	9	...	...	...	...	...	9	4	168	8	60	228	410	638
Loch Carron and Skye,	4	...	...	...	1	...	5	11	467	13	83	550	1,654	2,204
Fort William,	...	...	...	...	...	...	...	4	76	8	19	95	302	397
Campbeltown,	2	...	...	...	...	1	3	28	1,169	28	284	1,453	635	2,088
Inverarary,	...	...	...	...	...	...	...	...	...	...	...	...	1,449	1,449
Rothesay,	...	...	...	...	...	...	...	4	194	3	80	274	199	473
Greenock,	3	...	...	...	...	...	3	2	26	...	...	26	22	48
Ballantrae,	...	...	...	...	1	...	1	2	80	...	...	80	110	190
Grand Total for 1893,	92	1	1	6	15	8	123	97	14,835	224	6,920	21,755	46,466	68,221
Grand Total for 1892,	11	5	...	7	15	8	46	20	1,298	226	4,725	6,023	42,833	48,856
Increase in 1893,	81	...	1	...	...	...	77	77	13,537	...	2,195	15,732	3,633	19,365
Decrease in 1893,	...	4	...	1	...	...	...	...	...	2	...	...	...	...

APPENDIX J.

REGISTRATION OF FISHING BOATS.—ABSTRACT RETURN of Fishing Boat Proceedings in the Year 1893, under Sea Fisheries Acts of 1868 and 1883, and Sea Fisheries (Scotland) Amendment Act of 1885.

Districts.	Applications to Register.				Certificates Issued.				Certificates Examined and Endorsed.				Boats Detained.			
	First Class.	Second Class.	Third Class.	Total.	First Class.	Second Class.	Third Class.	Total.	First Class.	Second Class.	Third Class.	Total.	First Class.	Second Class.	Third Class.	Total.
Eyemouth,	...	...	...	...	...	...	...	...	...	...	...	...	23	7	...	30
Leith,	2	5	...	7	2	5	...	7	12	52	2	66	5	2	...	7
Anstruther,	19	23	...	42	19	23	...	42	230	123	...	353	...	...	...	...
Montrose,	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Stonehaven,	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	4
Aberdeen,	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Peterhead,	...	...	...	...	...	...	...	...	245	145	55	445	...	...	...	...
Fraserburgh,	...	...	...	...	...	...	...	...	227	270	19	516	5	...	...	5
Banff,	18	20	...	38	18	20	...	38	71	120	...	191	1	...	...	1
Buckie,	11	6	...	17	11	6	...	17	131	51	...	182	...	...	...	...
Findhorn,	...	...	...	...	...	...	...	...	...	...	...	...	5	3	...	8
Cromarty,	...	4	5	9	...	4	5	9	18	19	31	68	...	...	...	...
Helmsdale,	4	4	...	8	4	4	...	8	50	28	...	78	...	...	...	...
Lybster,	7	3	...	10	7	3	...	10	76	33	...	109	...	...	...	...
Wick,	10	5	...	15	10	5	...	15	229	95	...	324	...	...	...	...
Orkney,	1	4	...	5	1	4	...	5	12	25	...	37	...	...	...	...
Shetland,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Stornoway,	...	...	...	...	...	...	...	...	...	...	...	...	...	7	...	7
Barra,	3	5	1	9	3	5	1	9	13	48	36	97	...	1	...	1
Loch Broom,	1	8	11	20	1	8	11	20	32	96	48	176	...	1	11	12
Loch Carron & Skye,	1	28	17	46	1	28	17	46	15	346	311	672	...	...	...	...
Fort William,	...	8	5	13	...	8	5	13	2	91	89	182	...	...	...	...
Campbeltown,	...	26	...	26	...	26	...	26	25	206	...	231	...	6	...	6
Inveraray,	...	31	...	31	...	31	...	31	...	289	...	289	...	7	...	7
Rothesay,	...	6	16	22	...	6	16	22	2	143	41	186	...	4	...	4
Greenock,	...	...	...	...	...	...	...	...	...	49	1	50	...	...	...	...
Ballantrae,	...	8	...	8	...	8	...	8	2	198	...	200	...	...	...	...
H.M.S. 'Jackal,'	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2
Fishery Cruiser 'Vigilant,'	...	...	...	...	...	...	...	...	...	...	...	...	71	419	65	555
Fishery Superintendents,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18	18
Totals,	77	194	55	326	77	194	55	326	1,392	2,427	633	4,452	115	460	94	669

APPENDIX K.—No. I.

RETURN, by Districts, of COMPLAINTS made to Officers of the FISHERY BOARD, and Investigated and Reported on by them, of Injuries done by Beam Trawl Vessels or other Fishing Boats to the Boats, Nets, Lines, or Gear of Fishermen, in the Year 1893; and showing the Result in each case:—

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	EYEMOUTH DISTRICT.				
1893. Feb. 10	Carrying away haddock lines of boat 'Caledonia,' B.K. 882, by, it was alleged, the trading steamer 'Reindeer' of Dundee.	6 miles N. E. of St Abbs Head.	Outside.	Officer investigated case; complainants estimated the damage at £2, 5s.	On inquiry officer found that no such steamer belonged to Dundee. Complainants informed thereof and case departed from.
March 3	Carrying away haddock lines of boat 'Leader' of Eyemouth, L.H. 103, by steam trawler 'Ocean Prince' of North Shields, S.N. 112.	18 miles N. E. from Eyemouth.	Outside.	Officer investigated case, and assessed damage at £9.	After considerable correspondence with the managing owner of the 'Ocean Prince,' the case was settled by a payment of £7 to complainants through the officer.
Aug. 17	Damage to herring drift-nets of boat 'Alert' of Eyemouth, L.H. 89, by steam-tug 'Tyne' of Grangemouth.	6 miles off Newton.	Outside.	Officer investigated case, and assessed damage at £1, 17s. 6d.	Offender settled claim by making a payment of £1 through officer.
Aug. 31	Damage to herring drift-nets of boat 'Conquest' of Eyemouth, B.K. 1106, by steam-tug 'Blucher' of Grangemouth.	10 miles N. W. from Longstone Light House.	Outside.	Officer investigated case, and assessed damage at £4.	Owner of 'Blucher' repudiated responsibility. Complainants informed thereof, and no further action taken.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	LEITH DISTRICT.				
1893. Jan. 20	Damage to boat 'Perseverance,' L.H. 828, by boat 'Dido,' K.Y. 1600, through collision.	6 miles E. of May Island.	Outside.	Officer investigated case, and assessed the damage at £1, 12s. 6d.	Case allowed to drop.
Feb. 9	Damage to herring nets of boat 'Boy Peter,' L.H. 1090, by boat 'John Agnes,' K.Y. 235.	2 miles E.N.E. of Dunbar.	Inside.	Officer investigated case.	Complainers failed to identify the offender.
Feb. 16	Damage to boat 'New Favorite,' L.H. 892, by S.S. 'Britannia' of Leith through collision.	5 miles off Fidra.	Outside.	Officer investigated case, and assessed the damage at £32, 10s. 6d.	Respondent paid damage as assessed.
Feb. 21	Carrying away lines and fish thereon of boat 'Nil Desperandum,' L.H. 123, by steam trawler 'Malta II.,' G.N. 39.	5 miles E. of May Island.	Outside.	Officer investigated case and assessed the damage at £29, 11s.	Case tried before Sheriff, who found respondent at fault, and assessed damages at £25, 1s.
April 5	Damage to bowsprit of boat 'John and Agnes,' K.Y. 235, by steam trawler 'Choice,' G.N. 42.	Near Newhaven Harbour.	Inside.	Officer investigated case.	Case allowed to drop.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
1893.					
April 10	Cutting of crab nets of boat 'Industry,' L.H. 715, by small boats at Kirkcaldy.	¼ mile off Kirkcaldy.	Inside.	Officer forwarded a poster to Police Office, Kirkcaldy, warning parties.	Complaints ceased.
April 10	Damaging skate nets and taking fish therefrom of boat 'Maggie,' L.H. 810, by crews of pleasure boats.	1 mile off Portobello.	Inside.	Officer issued posters through Police Office, Portobello, and warned owners of pleasure boats.	Complaints ceased.
June 3	Damaging skate nets and taking fish of boat 'Eclipse,' L.H. 601, by pilot boats from Burntisland.	1 mile N. from Inchkeith.	Inside.	Officer investigated case and found that offenders came from Inchkeith — assessed damage at 20s.	Respondent paid damage as assessed.
Oct. 7	Damage to flagstaff, &c. of boat 'Hebe,' L.H. 11, by trawler 'Commodore,' G.N. 33.	23 miles E.S.E. of May Island.	Outside.	Officer investigated case, and assessed damage at 10s.	Respondent paid damage as assessed.
Nov. 16	Carrying away lines and fish thereon of boat 'Chieftain,' L.H. 1091, by steam trawler 'Wallace,' G.N. 12.	30 miles E. of May Island.	Outside.	Officer investigated case, and assessed damage at £13, 6s. 1d.	Case taken to Court and not yet settled.
Nov. 16	Carrying away lines and fish thereon of boat 'Annie,' L.H. 1056, by steam trawler 'Wallace,' G.N. 12.	30 miles E. of May Island.	Outside.	Officer investigated case, and assessed damage at £7, 17s. 10d.	Case taken to Court and not yet settled.

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	ANSTRUTHER DISTRICT.				
1893. Jan. 18	Fouling and carrying away lines of boat 'Myrtle Home,' L.H. 1073, by John Cross, fisherman, St Andrews.	Near May Island.	Inside.	Officer communicated with Cross regarding complaint.	Accused found to be innocent, and missing lines discovered in the possession of another St Andrews fisherman. Lines ultimately returned to owner.
Jan. 21	Fouling and carrying away lines of boat 'Grace Wood,' K.Y. 2061, by steam trawler 'Wallace,' G.N. 12.	2½ miles E. of May Island.	Inside.	Officer investigated case, assessed damage at £2, 15s., and communicated with owners of trawler.	Respondent denied liability and the case was allowed to lapse.
Feb. 3	Fouling and carrying away line of boat 'Maggie' of Prestonpans, L.H. 1089, by a Pittenweem boat unknown.	5 miles E. of May Island.	Outside.	Officer visited Pittenweem and enquired into case.	Found missing line in possession of a fisherman at Pittenweem. Line immediately returned to owners.
Nov. 2	Fouling and carrying away lines of boat 'Rob the Ranter,' K.Y. 458, by steam trawler 'Sarah,' S.N. 91.	60 miles S.E. of May Island.	Outside.	Officer investigated case, assessed damage at £1, 15s., and communicated with owner of trawler.	Respondent offered £1 in settlement of claim, which was accepted.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	MONTROSE DISTRICT.				
1893. Dec. 25	Damage to lines of fishing boats 'Jones,' D.E. 405, 'Elizabeth,' D.E. 1, 'Grace,' D.E. 402, and 'May Flower,' D.E. 380, all belonging to Broughty Ferry, by steam trawler 'Flying Scud,' D.E. 48 of Dundee.	2 miles E. by N. of Bell Rock.	Outside.	Officer communicated with managing owner of trawler on the subject.	Managing owner of trawler admitted liability and offered £6 in full of claim, which complainers accepted.
	STONEHAVEN DISTRICT.				
Jan. 18	Damage to nets of boat 'Venture' of Stonehaven, A. 129, by steam line boat 'Salamander' of Leith, L.H. 4.	3½ miles off Dunnottar Castle.	Outside.	Officer investigated the case.	Respondent admitted liability, and having expressed regret for causing the damage, the complainer allowed the matter to drop.
Feb. 2	Damage to lines of boat 'Transatlantic' of Stonehaven, A. 451, by boat 'Mary and Ann' of Stonehaven, A. 493.	5 miles off Crawton Ness.	Outside.	Officer investigated the case, and assessed the damage at 10s.	Case settled by the respondent paying part of the damage.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
1893.					
Feb. 17	Carrying away of lines of boat 'Blooming Heather' of Stonehaven, A. 80, by boat 'Nymph' of Stonehaven, A. 586.	1 mile off Dunnottar Castle.	Inside.	Officer investigated the case, and assessed the damage at 30s.	Complainer accepted 25s. in full of claim.
July 5	Damage to lines of boat 'Brothers' of Stonehaven, A. 628, by boat 'Isabella,' A. 470.	2 miles off Stonehaven.	Inside.	Officer investigated the case, and assessed the damage at 10s.	Claim settled by respondent paying damage as assessed.
July 25	Damage to nets of boat 'Loch Carron' of Stonehaven, A. 540, by boat 'Defiance' of Stonehaven, A. 352.	8 miles off Stonehaven.	Outside.	Officer investigated the case, and assessed the damage at £8, 10s.	Respondent denied liability. No further action taken.
July 25	Damage to nets of boat 'Fancy' of Stonehaven, A. 471, by smack 'Jane' of Banff.	9 miles off Stonehaven.	Outside.	Officer investigated the case, and assessed the damage at 25s.	Respondent denied liability. No further action taken.
Oct. 4	Damage to lines of boat 'Alert' of Stonehaven, A. 579, by steam trawler 'Victory' of North Shields, S.N. 1407.	8 miles off Crawton Ness.	Outside.	Officer investigated the case, and assessed the damage at £1, 10s.	Damage as assessed paid through officer.
Nov. 1	Damage to lines of boat 'Ocean Pride' of Stonehaven, A. 724, by boat 'Heather Bell' of Stonehaven, A. 717.	4 miles off Crawton Ness.	Outside.	Officer investigated the case, and found no evidence to prove that accused had caused the damage.	Case dismissed.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	ABERDEEN DISTRICT.				
1893.					
Jan. 27	Damage to lines of boat 'Pioneer' of Torry, A. 551, by boat 'G. T. Walker' of Portlethen, A. 261.	About 3 miles off Portlethen.	Inside.	Officer investigated the case, and assessed the damage at 6s. 6d.	Case settled by respondent paying damage as assessed.
May 18	Damage to lines of boat 'Scotch Lassie,' A. 692, by steam trawler 'Royal Saxon,' A. 621.	10 to 12 miles S.E. from Aberdeen.	Outside.	Officer investigated the case, and assessed the damage at 50s.	Case settled by respondent paying damage as assessed.
May 18	Damage to lines of boat 'Scotch Lassie,' A. 692, by steam trawler 'Crown Prince,' S.N. 92.	10 to 12 miles S.E. from Aberdeen.	Outside.	Respondent admitted liability.	Claim of 30s. paid and case settled.
July 19	Damage to lines of boat 'Peter Esslemont,' A. 575, by boat 'Isabella,' A. 611.	2 miles off Cove.	Inside.	Officer investigated the case.	Evidence insufficient and case dismissed. No further action taken.
	PETERHEAD DISTRICT.				
Jan. 25	Causing loss of eight strings of small lines belonging to boat 'Flying Beauty,' P.D. 1286, by boat 'Helen and Martha,' P.D. 34.	About 14 miles off Peterhead.	Outside.	Officer investigated the case by hearing both parties, and estimated damage at 30s.	Damage found unavoidable.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
1893.					
Feb. 20	Damage to lines of boat 'Lily of the Valley,' P.D. 1430, by steam trawler 'Sunrise,' A. 648.	About 12 miles E.N.E. off Peterhead.	Outside.	Officer investigated the case by examination and correspondence, and assessed the damage at 20s.	Case settled by respondent paying the amount assessed.
Feb. 21	Carrying away one line of boat 'Helen and Martha,' P.D. 34, by boat 'Press Home,' P.D. 1240.	From 8 to 10 miles off Peterhead.	Outside.	Officer investigated case by hearing both parties. Damage estimated at 30s.	Damage found unavoidable; lines getting foul owing to the state of the tide.
June 9	Carrying away four nets belonging to boat 'Morning Star,' P.D. 48, by dan of steam trawler 'Dauntless,' S.N. 1381.	From 7 to 8 miles off Peterhead.	Outside.	Officer investigated case by examination and correspondence, and assessed damage at £6, 10s.	Respondent paid damage as assessed.
Aug. 8	Carrying away of and damage to nets belonging to boat 'Olive Branch,' P.D. 515, by steam trawler 'Stephenson,' S.N. 8.	5 miles off Boddam.	Outside.	Officer investigated case by examination and correspondence and assessed damage at £4.	Respondent denied liability and no further action was taken.
Aug. 15	Bush rope cut and nets carried away of boat 'Families Pride,' P.D. 1320, by boat 'Good Hope,' K.Y. 343.	4 miles S. of Boddam.	Outside.	Officer investigated case by hearing both parties. Damage assessed at £60.	Respondent refused to give compensation, and case taken to Court, when Sheriff awarded £25 in lieu of damages.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
1893. Dec. 21	Carrying away lines of boat 'Families Pride,' P.D. 1396, by boat 'Pioneer,' P.D. 1353.	About 5 miles off Peterhead.	Outside.	Officer investigated case by hearing both parties. Damage assessed at £4, 10s.	Complainers accepted £2 in settlement of claim.
Dec. 27	Carrying away lines of boat 'Eliza,' P.D. 1226, by boat 'Fancy,' P.D. 55.	About 15 miles off Peterhead.	Outside.	Officer investigated case by hearing both parties. Damage assessed at £5, 11s.	Found that respondent was not to blame for the loss.
	FRASERBURGH DISTRICT.				
April 7	Damage to haddock lines of boat 'Betsy and Isabella,' F.R. 31, of Fraserburgh, by the steam trawler 'S.S. Lily,' S.N. 50 of South Shields.	18 miles E. by N. of Kinnaird Head.	Outside.	Officer investigated case.	Case settled by complainers accepting £2 in full of claim.
	BANFF DISTRICT.				
July 21	Damage to nets of boat 'En Evant,' B.F. 796, of Banff, by boat 'Mine and Thine,' I.N.S. 296, of Avoch.	30 miles off Troup Head.	Outside.	Officer investigated case.	Found that loss was caused by accidental fouling, and that the respondent sustained greater loss than the complainer. No further action taken.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	BUCKIE DISTRICT.				
1893. Oct. 24	Damage to lines of fishing boat 'Union,' B.F. 1098 by fishing boat 'Queen Victoria,' B.F. 943.	18 miles N.E. of Buckie.	Outside.	Officer investigated the case.	Case dismissed as evidence against respondent insufficient.
	FINDHORN DISTRICT.				
Jan. 12	Damage to lines of boat 'Mary Cowie' of Lossiemouth, I.N.S. 78, by boat 'Francious' of Hopeman, I.N.S. 57.	4 miles S.S.E. of Helmsdale.	Outside.	Officer investigated case, and assessed the damage at 7s. 6d.	Respondent denied liability. No further steps taken.
	LYBSTER DISTRICT.				
Feb. 3	Carrying away four nets and part of bush rope of boat 'Jeanie Alice,' B.F. 964, by steam trawler 'Lycurgus,' H. 93.	3 miles off Lybster.	Inside.	Officer investigated case, and estimated the damage at £20.	Owner of trawler offered £10 in settlement of claim which was accepted by complainers.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	WICK DISTRICT.				
1893. Feb. 6	Carrying away three nets, damaging other three, and also injuring bush rope of boat 'Alaska,' W.K. 1173, by steam trawler 'Premier,' S.N. 56.	4 miles off Sandside.	Outside.	Officer investigated case, and estimated the damage at £15.	Respondent denied liability, and case departed from.
Aug. 25	Cutting off 14 buoys and damaging 11 nets of boat 'Malinka,' W.K. 752, by boat 'Ann and Ellen,' W.K. 353.	1½ miles off Forse.	Inside.	Officer investigated case, and estimated damage at £12.	Found that loss and damage was caused by accidental fouling. Respondent also complained of loss.
	SHETLAND DISTRICT.				
July 17	Cutting away of nets of boat 'Snowdrop' of Hillswick, L.K. 306, by boat 'Faith' of Whiteness, L.K. 514, making fast to them.	Between 1 and 2 miles from Swaerback.	Inside.	Officer investigated case, and estimated damage at £3.	Respondent admitted liability, and offered 30s. in full of claim which was accepted by complainer.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
1893.					
Nov. 13	Cutting away part of the lines of boat 'Maggie,' L.K. 586, by boat 'Kate,' L.K. 2417, both of Lerwick.	In Quarff Bay.	Inside.	Officer investigated case, and estimated damage at 5s.	Respondent admitted cutting the lines but refused to pay the damage. Case afterwards heard before the Sheriff who adhered to officer's decision and awarded damages and expenses.
	BARRA DISTRICT.				
Dec. 14	Damage to boat 'Advice,' C.Y. 103, while lying at anchor, by boat 'Welcome Home,' C.Y. 104.	At Castlebay, about 50 yards from the shore.	Inside.	Officer investigated case by hearing both parties. Damage estimated at £2.	Case compromised by complainers and respondents paying equal share of the expense of repairing the boat.
	LOCH CARRON DISTRICT.				
Sept. 22	Damage to nets of boat 'Rose,' 68 B.R.D., by boat 'Polly and Bella,' 44 B.R.D.	Loch Eyshort.	Inside.	Officer investigated case by examination and correspondence.	Respondents agreed to make good the damage.
Oct. 24	Sinking of boat 'Rolling Wave,' 684 I.N.S., through collision with boat 'Christina,' 1680, B.F.	Loch Eyshort.	Inside.	Officer investigated case by hearing both parties.	Respondents paid £8, 2s. 6d. in settlement of claim.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	FORT WILLIAM DISTRICT.				
1893. May 15	Damage to great lines of boat 'Flowerdale' of Tiree, C.K. 554, by steam trawler 'Chindevin,' H. 34.	5 miles S.E. of Hynish Point, Tiree.	Outside.	Officer investigated case, and assessed the damage at £4, 10s.	Respondent paid £3 through officer which complainers accepted in settlement of claim.
May 20	Damage to great lines of boat 'Flowerdale' of Tiree, C.K. 554, by steam trawler 'Magneta,' H. 1447.	8 miles E. of Hynish Point, Tiree.	Outside.	Officer investigated case, and assessed damage at £9.	Respondent paid £5 through officer which complainers accepted in settlement of claim.
May 30	Damage to great lines of boat 'Flowerdale' of Tiree, C.K. 554, by steam trawler 'Commodore,' G.N. 31.	8 miles E. of Hynish Point, Tiree.	Outside.	Officer investigated case.	Found evidence insufficient to prove that the damage was caused by respondent.
	CAMPBELTOWN DISTRICT.				
Mar. 3	Damage to lines of boats 'Bella,' 414 C.W., and 'May Flower,' 208 C.W. of Gigha, by beam trawler name and number unknown.	3 to 6 miles S.E. of Island of Gigha.	Outside.	Officer investigated case, and assessed damage at £2, 10s.	Trawler not identified.

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
	INVERARAY DISTRICT.				
1893. July 29	Carrying away four nets of boat 'Duncallian Castle,' 491, G.K., by fish carrying steamer 'Tartar' of Glasgow.	Off Skipness Point, Lochfyne.	Inside.	Officer investigated case by examination and correspondence.	As the fishing boat had not had her lights up when loss was caused, case was dismissed.
Aug. 25	Carrying away nets of boat 'Neva,' 4523 G.K., by fish carrying steamer 'Marie' of Glasgow.	Off Newton, Lochfyne.	Inside.	Officer investigated case, and assessed damage at £6.	Respondent offered £2 in settlement of claim which sum complainer refused. Case not yet settled.
	BALLANTRAE DISTRICT.				
Mar. 9	Carrying away of great lines of boat 'John and Margaret,' A.R. 367, by steam trawlers.	East side of Ailsa Craig, 12 miles from shore.	Outside.	Officer investigated case, but could find no evidence of trawlers having been on the coast.	Line afterwards grappled for by complainers, and recovered.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
1893. Mar. 19 to 24	Carrying away lines of boats 'Robina,' S.R. 433, 'Prince of Wales,' S.R. 202, 'Carrier Dove,' S.R. 560, 'Elizabeth,' S.R. 570, 'Jessie Walker,' S.R. 440, 'Emerald,' S.R. 360, 'Bellona,' S.R. 275, 'Margaret,' A.R. 7, 'Bonnie Lochryan,' S.R. 453, 'Defiance,' S.R. 251, and 'Hope,' S.R. 476, by steam trawler 'Volta' of Hull, H. 111.	8 to 12 miles off Ballantrae, and also about 5 miles off the mouth of Lochryan.	Outside.	Officer investigated cases, and found that the 'Volta' had been at work over the ground where the missing lines were set, between the 18th and 20th March. Cases reported for prosecution.	Cases tried before Sheriff at Ayr on 9th May. Respondent found guilty and fined £30. In addition £30 was paid in compensation for loss of lines, which sum was apportioned among the crews who suffered loss.
Apr. 22	Carrying away great lines of boats 'Carrier Dove,' S.R. 560, 'Robina,' S.R. 433, and 'Prince of Wales,' S.R. 202.	8 to 12 miles off Ballantrae.	Outside.	Officer investigated cases.	Lines damaged when crews were on shore and evidence insufficient to indicate by whom the loss was caused.
Apr. 27	Carrying away great lines of boats 'Four Brothers,' S.R. 443, and 'Elizabeth,' S.R. 570.	E. of Ailsa Craig, 12 miles from shore.	Outside.	Officer investigated cases.	Lines damaged when crews were on shore and evidence insufficient to indicate by whom the loss was caused.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
1893.					
Apr. 30	Carrying away great lines of boat 'Minnie' of Carradale, C.N. 104.	E. of Ailsa Craig, 12 miles from shore.	Outside.	Officer investigated case.	Lines damaged when crews were on shore and evidence insufficient to indicate by whom the loss was caused.
Aug. 10	Loss of and damage to nets of boats 'Elizabeth,' S.R. 570, and 'Prince of Wales, S.R. 202.	N.W. of Ailsa Craig, 12 miles from shore.	Outside.	Officer investigated cases.	Lines damaged when crews were on shore and evidence insufficient to indicate by whom the loss was caused.
	FISHERY CRUISER 'VIGILANT.'				
Feb. 21	Colliding with and cutting ropes of seine net boats by Girvan fishermen.	Girvan Harbour.	Inside.	Commander visited Girvan and investigated complaints.	Local authorities took steps to prevent recurrence of offence.
Feb. 25	Damage to nets of boat R.O. 27, by S.S. 'Mary.'	Off Ardlamont Point.	Inside.	Commander communicated with master of steamer.	Case settled by respondent paying £2.
Mar. 23	Damage to lines of boat A.R. 275, by steam trawler H. 111.	Off Corsewell Point.	Outside.	Commander investigated complaint.	Found no evidence against accused.

APPENDIX K.—No. I.—*continued.*

Date of Alleged Offence.	Nature of Complaint.	Locality and Distance from Shore.	Whether Inside or Outside Territorial Limits.	Steps taken.	Result.
1893.					
May 12	Damage to lines of boats, S.R. 560, 433, 202, 443, 570, and C.N. 104, alleged to have been caused by steam trawler L.L. 110.	From 2 to 5 miles off Ailsa Craig.	Inside.	As the complaints were only lodged with the Commander 18 days after the damage was done, it was impossible to obtain reliable information.	*Note.*—The steam trawler L.L. 110 was detected by 'Vigilant' on 28th April, at work about 15 miles S.E. from Mull of Cantyre, and was brought into Campbeltown for breach of fishery regulations, and it was upon this being made known to the fishermen that they lodged their complaints through the Board's officer at Girvan.
June 16	Collision, S.Y. 23 *v.* S.Y. 179.	Off Arnish Point.	Inside.	Commander investigated complaint and assessed damage at 35s.	Accused found at fault.
June 28	Collision, W.K. 482 *v.* I.N.S. 1107.	At Loch Inver	Inside.	Commander investigated complaint and assessed damage at 35s.	Accused found at fault who supplied complainer with a new rudder.
	H.M.S. 'JACKAL.'				
July 5	Carrying away line and buoy rope of steam line boat 'Auster Fair,' K.Y. 461, by French lugger G. 266.	60 miles S.E. by E. of Aberdeen.	Outside.	Case reported to the Captain of the French cutter 'Sardine.'	Captain of the cutter promised to search the boat G. 266, if he met her at sea.

APPENDIX K.—No. II.

RETURN, by Districts, of PROSECUTIONS against BEAM TRAWL VESSELS in the year 1893, for Alleged Infringement of the Bye-Laws of the Fishery Board, or the Provisions of the Herring Fishery (Scotland) Act, 1889, Prohibiting Beam Trawling within certain Waters round the Coasts of Scotland, showing the Result in each Case.

Date of Alleged Offence.	Name of Accused, &c.	Nature of Alleged Offence, and where committed.	Place and Mode of Trial.	Result of Trial.
1893.	ABERDEEN DISTRICT.			
Feb. 19	Albert Baldwin, master of steam trawler 'North Wind,' A. 639.	Beam trawling in the Moray Firth, within limits.	At Aberdeen, before the Sheriff, summarily.	Fine of £5, or one month's imprisonment.
Feb. 19	William Potter, master of steam trawler 'Premier,' S.N. 56.	Beam trawling in the Moray Firth, within limits.	At Aberdeen, before the Sheriff, summarily.	Fine of £5, or one month's imprisonment.
	LYBSTER DISTRICT.			
Feb. 2	William Just, master of steam trawler 'Lycurgus' of Hull, H. 93.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling 6 miles off Lybster.	At Wick, before the Sheriff, summarily.	Fine of £5.
	WICK DISTRICT.			
Feb. 2	William Potter, master of steam trawler 'Premier,' S.N. 56.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling off Bighouse Head.	At Dornoch, before the Sheriff, summarily.	Fine of £30, or 30 days imprisonment. Fine paid.
Feb. 2	William Warman, master of steam trawler 'Scottish Belle,' A. 512.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling off Bighouse Head.	At Dornoch, before the Sheriff, summarily.	Fine of £30, or 40 days imprisonment. Fine paid.

APPENDIX K.—No. II.—*continued.*

Date of Alleged Offence.	Name of Accused, &c.	Nature of Alleged Offence, and where committed.	Place and Mode of Trial.	Result of Trial.
1893.	ORKNEY DISTRICT.			
July 13	George Leslie, master of the steam trawler 'North Breeze' of Aberdeen, A. 644.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling in Rackwick Bay, within 3 miles from shore.	At Kirkwall, before the Sheriff, summarily.	Fine of £50, or 2 months imprisonment.
July 13	Andrew Mackenzie, master of the steam trawler 'Maggie Walker' of Aberdeen, A. 259.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling in Rackwick Bay, within 3 miles from shore.	At Kirkwall, before the Sheriff, summarily.	Fine of £50, or 2 months imprisonment.
July 13	Alexander Adam, master of the steam trawler 'North West' of Aberdeen, A. 478.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling in Rackwick Bay, within 3 miles from shore.	At Kirkwall, before the Sheriff, summarily.	Fine of £50, or 2 months imprisonment.
	SHETLAND DISTRICT.			
July 21	Alexander Adam, master of the steam trawler 'North West' of Aberdeen, A. 478.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling in Rackwick Bay, within 3 miles of Foula Island.	At Lerwick, before the Sheriff, summarily.	Fine of £100, or 60 days imprisonment.
	CAMPBELTOWN DISTRICT.			
April 28	Thomas Brett, master of the steam trawler 'Goeland' of Liverpool, L.L. 110.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling 9 miles to the S.E. or S.S.E. of the Island of Sanda.	At Campbeltown, before the Sheriff, summarily.	Fine of £20, or 30 days imprisonment.

APPENDIX K.—No. II.—*continued.*

Date of Alleged Offence.	Name of Accused, &c.	Nature of Alleged Offence, and where committed.	Place and Mode of Trial.	Result of Trial.
1893.	BALLANTRAE DISTRICT.			
Mar. 19	B. H. Galvin, master of steam trawler 'Volta' of Hull, H. 111.	Contravention of the Herring Fishery (Scotland) Act, 1889. Beam trawling in the Firth of Clyde, within limits.	At Ayr, before the Sheriff, summarily.	Fine of £30.

APPENDIX L.—No. I.

Report by the Engineers on the state of the Harbour Works in progress under their supervision during the year 1893.

We have now the honour to report on the state of the Harbour Works in progress under our supervision during the year 1893 :—

Broadford Harbour, Isle of Skye.—The road of access to the harbour from the Turnpike Road was finished during the season by Messrs Stratton, contractors. This road will enable the harbour to be easily reached from the main road, the old road being very circuitous with steep gradients. The harbour, as completed, affords an easy and convenient means of sending the produce of the fisheries to the southern markets, as the regular steamers are able to come alongside at all states of the tide.

Port Ness Harbour, Island of Lewis.—The works at Port Ness have not been so vigorously prosecuted by the contractor as they might have been, but they are now practically finished, except the excavation in the interior of the harbour.

In connection with the harbour works at Port Ness, the Treasury have been pleased to make a grant to meet the cost of erecting a breakwater to shelter the new entrance, and also to afford protection to the fishing boats, which at particular seasons congregate here. The works have been let to Messrs Brand & Son, Glasgow, who are contractors of experience. They began operations in June last, and are now actively engaged in prosecuting the works.

Balintore Harbour, Ross-shire.—The Balintore harbour works were completed in September last, with the exception of the levelling of a small portion of rock outside the harbour, which, on account of the stormy nature of the weather, and the unsuitability of the tides, the contractor has not been able to finish.

Craigenroan Boat Harbour of Refuge.—The subject of providing a Boat Harbour of Refuge for the coast of Banffshire was under consideration as far back as the year 1858, in consequence of the loss of life during the gale of November 1857, when 42 fishermen overtaken by the storm perished. After a careful survey of the coast in 1858, we came to the conclusion that Craigenroan was the best position for such a harbour, but funds were not forthcoming to admit of the works being carried out. The demand for a harbour of refuge to which boats could run when overtaken by a storm is now even more urgent than it was thirty-five years ago. Harbours which were suitable for the type of boats of 1857 cannot now be taken in certain states of the tide by modern boats, which draw, when laden, from 4 to 10½ feet. To meet this increased draft of boats, Harbour Authorities are deepening and improving the harbours under their care; but a low-water refuge harbour for fishing boats is in a different position, as there is no constituted local authority having the requisite funds available for carrying out the work, and it is urged that such a refuge harbour stands in the same relation to the fisheries as Peterhead Refuge Harbour, now in progress at national expense, does to general navigation.

Craigenroan has recently been urged on the attention of the Govern-

ment, and, as requested by the Board, we reported, of dates 30th June and 10th July, that a Boat Refuge Harbour could be constructed for £24,000. We understand the subject is now under the consideration of the Secretary for Scotland.

COLLIESTON HARBOUR, ABERDEENSHIRE.—The Harbour Trustees submitted a design for a harbour, prepared by Mr Barron, C.E., and for which they are this year applying for a Provisional Order. Of this design we could not approve, and, in terms of the remit of the Board, we made a marine survey and soundings of the Bay of Collieston, with the view of designing a harbour, the cost of which would not exceed £6000. We thereafter designed such a harbour, and we understand that this design, with certain modifications of which we do not approve, is now to be carried out, with a grant from the Board, by Mr Melville of Aberdeen.

D. & C. STEVENSON.

EDINBURGH, 8*th May* 1894.

APPENDIX L.—No. II.

HARBOUR WORKS.—ACCOUNT of RECEIPTS and PAYMENTS by the Fishery Board for Scotland for Building, Extending, and Repairing PIERS or HARBOURS in Scotland in the year 1893.

Dr. *Cr.*

1892.						
Dec. 31.	To Balance				£5 014 6 10	
1893.	PARLIAMENTARY GRANT.					
Mar. 31.	To Parliamentary Grant for Piers or Quays (5 Geo. IV. cap. 64), year ended 31st March 1893,				3,000 0 0	
	BANK INTEREST.					
Mar. 31.	„ Bank Interest on balance on Deposit Receipt			£74 11 8		
Aug. 31.	„ do.	do.	do.	61 9 6		
Sept. 30.	„ do.	do.	do	16 4 0		
					152 5 2	
					£8,166 12 0	

1893.						
Dec. 31.	By Payments for Harbour Works during the year ended this date, viz. :—					

Name of Harbour.	Works.	Inspectors' Wages.	Engineer's Fees.	Total.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Portknockie, .	...	...	148 7 2	148 7 2
Broadford, .	435 0 0	...	...	435 0 0
Balintore, .	270 16 11	31 10 0	150 0 0	452 6 11
Ness, . .	1,226 0 0	124 8 6	...	1,350 8 6
Sandend, . .	250 0 0	...	...	250 0 0
£	2,181 16 11	155 18 6	298 7 2	2,636 2 7

„ „ *By Payment to the Public Works Loan Board in respect of Guarantee of Loan to the Eyemouth Harbour Trustees, ...	182 0 10	
„ „ Balance on Hand, ...	5,348 8 7	
	£8,166 12 0	

* See explanatory note at foot of Appendix L, No. III.

APPENDIX L.—No. III.

Eyemouth Harbour Loan Guarantee.

Statement showing the position of the Funds at 31st December 1893.

1891. Mar. 31	To amount transferred from Surplus Brand Fees, 1890–91, as a reserve fund.	£1824	1892. Oct. 28	By payment of half-yearly instalment,	£86 8 5
			1893. Mar. 30	Do. Do.	148 11 9
			Dec. 31	By Balance of Reserve Fund,	1588 19 10
		£1824			£1824 0 0

Note.—In the event of the Eyemouth Harbour Revenue proving insufficient, the Board are liable, in virtue of a memorandum signed by the Secretary for Scotland, for the repayment of a loan granted by the Public Works Loan Board to the Eyemouth Harbour Trustees. A sum of £1824 was, by order of the Secretary for Scotland, specially set apart from the Surplus Brand Fees voted by Parliament in the financial year 1890–91 to meet this guarantee in the event of there being no Surplus Brand Fees in any future year, or in the event of the whole of the Surplus Brand Fees in any year being required for payments of guarantees already given to the Post Office for the extension of the telegraph to remote districts, these forming a first charge on the fees. (See Appendix M.) Both of the payments falling due in the financial year 1892–93 were made out of the Reserve Fund, there having been no Surplus Brand Fees to vote for that year. In 1893–94, however, there was a balance available out of the Surplus Brand Fees of sufficient amount to meet the claim of £182, 0s. 10d. made by the Loans Board, and that sum was, as shown in Appendix L. No. II., paid out of the Piers and Quays Account (into which the grant of Surplus Brand Fees for the year is paid.)

APPENDIX M.

TELEGRAPHIC EXTENSION.—ACCOUNT of RECEIPTS and PAYMENTS by the Fishery Board for Scotland, for TELEGRAPHIC EXTENSION to Remote Fishery Districts in Scotland in the year 1893.

Dr. *Cr.*

1893.	PARLIAMENTARY GRANT.		
Mar. 31.	To Transfer from Board's Vote of Expenditure for the year ended 31st December 1892 chargeable against "Grant in Aid of Telegraphic Extension," for year ended this date,		£620 4 0
	To Amounts received from Co-Guarantors to meet their proportion of the deficits in receipts from inland messages forwarded from the following telegraph offices, viz.:—		
May 12.	Lochbuie, Mull,	£2 18 0	
Oct. 19.	Ness, Lewis,	20 0 0	
			22 18 0
Dec. 31.	To Balance at this date,		514 18 9
			£1,158 0 9

1892.			
Dec. 31.	By Balance,		£413 11 0
	By Guarantees paid to H.M. Postmaster General to meet the deficits in receipts from inland messages forwarded from the following telegraph offices, viz.:—		
1893.			
May 12.	Lochbuie, Mull,	£5 16 0	
June 21.	Barvas, Ross,	4 12 10	
,, ,,	Garrabost, Ross,	4 5 9	
Aug. 21.	Achiltibuie, Ross,	56 5 8	
Sept. 16.	Durness, Sutherland,	105 19 6	
,, ,,	Coll and Tiree, Argyll,	270 4 5	
,, 22.	Brae, Ollaberry, &c., Shetland,	33 16 7	
,, ,,	Hillswick, Shetland,	26 7 1	
Oct. 21.	Ness, Lewis,	113 9 4	
,, ,,	Portnaguran and Back, Ross,	63 11 0	
Dec. 15.	Arisaig, Inverness,	60 1 7	
			744 9 9
			£1,158 0 9

APPENDIX N.—No. I.

LOANS TO FISHERMEN—STATEMENT showing the NUMBER OF LOANS CARRIED OUT in each Crofting Fishery District, the amount paid over, and the TOTAL INSTALMENTS RECEIVED (inclusive of interest and sums received for seized boats) from the date when the Crofters Holdings Act, 1886, came into operation, to 31st December 1893, together with the NUMBER OF LOANS and AMOUNT of INSTALMENTS in ARREAR.

DISTRICTS.	Total No. of Loans carried out.	Amount advanced as Loans, To 31st Dec. 1889.	Amount advanced as Loans, To 31st Dec. 1890.	Amount advanced as Loans, To 31st Dec. 1891.*	Total Instalments, including Interest and Sums received for Seized Boats, up to 31st Dec. 1893.	Arrears. No. of Loans.	Arrears. Amount.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.		£ s. d.
Cromarty, . .	2	303 10 0	303 10 0	303 10 0	178 9 1	1	35 7 7
Helmsdale, . .	9	1,269 0 0	1,519 0 0	1,519 0 0	583 9 11	9	495 7 0
Lybster, . .	7	907 0 0	967 0 0	967 0 0	581 5 2	7	487 19 9
Wick, . . .	72	7,096 1 6	9,852 1 6	9,852 1 6	5,817 19 9	49	2,896 13 7
Orkney, . .	6	635 0 0	635 0 0	635 0 0	444 7 4	3	169 8 7
Shetland, . .	20	1,816 18 0	1,861 18 0	1,861 18 0	1,410 1 0	10	448 16 9
Stornoway, . .	101	6,526 11 9	11,615 11 9	12,283 11 9	6,100 13 3	76	2,908 10 6
Barra, . . .	20	1,604 16 4	1,888 6 4	1,888 6 4	1,287 11 4	9	474 7 1
Loch Broom, .	8	767 9 0	767 9 0	767 9 0	319 18 1	8	375 6 6
Fort William, .	1	...	34 0 0	34 0 0	32 6 11	...	...
Totals,	246†	20,926 6 7	29,443 16 7	30,111 16 7	16,756 1 10	172	8,291 17 4

* No loans were made in 1892 or 1893.

† In four cases of loans the boats mortgaged in security were seized by the Board for non-payment of arrears and sold to other crews, the price being paid partly in cash and partly by fresh mortgages.

APPENDIX N.—No. II.

RETURN of ARREARS of LOANS granted on security of Boats, mortgaged to the Board, deemed to constitute Bad Debts, as at 31st December 1893.

Fishery Districts in which Loans were made.	Number of Application.	Number of Borrowers in each case.	Dates when Loans were granted.	Amount of Loans.	Amounts Repaid by Borrowers.	Expenses Incurred in Prosecutions, Seizures, or Sales.	Dates when Boats were Abandoned, Surrendered, Seized, or Wrecked.	Dates when Boats were Sold.	Amounts realised by Sales or recovered from Insurance Companies.	Net Proceeds of Sales Credited to Borrowers' Accounts.	Outstanding Balances, Exclusive of Interest, Considered Irrecoverable.	Grounds on which Arrears of Loans are deemed to constitute Bad Debts.
				£ s. d.	£ s. d.	£ s. d.			£ s. d.	£ s. d.	£ s. d.	
Shetland, .	284	three	1888 March	184 0 0	46 3 8	3 4 1	1892 November	1893 January	61 5 0	58 0 11	79 15 5	Boat given up by borrowers.
Stornoway, .	313	seven	April	36 0 0	12 18 6	...	1893 January	,,	10 0 0	10 0 0	13 1 6	Do. do.
Wick, . .	769	four	1889 Sept.	114 0 0	24 8 9	6 7 1	1892 December	,,	66 0 0	59 12 11	29 18 4	Do. do.
Stornoway, .	717	,,	Nov.	90 0 0	15 0 0	0 12 6	1893 March	February	22 10 0	21 17 6	53 2 6	Do. do.
Wick, . .	823	two	1890 Feb.	200 0 0	30 0 0	2 3 8	,,	March	166 0 0	163 16 4	6 3 8	Boat seized, as borrowers would pay no more.
Do. . .	796	three	1889 Nov.	265 0 0	7 0 0	5 11 1	1892 December	January	110 0 0	104 8 11	153 11 1	Boat given up by borrowers.
Lybster, . .	600	two	1888 Oct.	262 0 0	47 11 10	1 13 8	1893 March	March	83 0 0	81 6 4	133 1 10	Do. do.
Stornoway, .	412	six	,,	174 18 0	7 12 2	3 11 2	May	January	54 0 0	50 8 10	116 17 0	Boat seized, as borrowers would pay no more.
Do. . .	439	seven	July	113 0 0	7 13 0	1 9 8	,,	,,	46 0 0	44 10 4	60 16 8	Do. do.

APPENDIX N.—No. II.—*continued.*

Fishery Districts in which Loans were made.	Number of Application.	Number of Borrowers in each case.	Dates when Loans were granted.	Amount of Loans.	Amounts Repaid by Borrowers.	Expenses Incurred in Prosecutions, Seizures, or Sales.	Dates when Boats were Abandoned, Surrendered, Seized, or Wrecked.	Dates when Boats were Sold.	Amounts realised by Sales or recovered from Insurance Companies.	Net Proceeds of Sales Credited to Borrowers' Accounts.	Outstanding Balances, Exclusive of Interest, Considered Irrecoverable.	Grounds on which Arrears of Loans are deemed to constitute Bad Debts.
			1888	£ s. d.	£ s. d.	£ s. d.	1893	1893	£ s. d.	£ s. d.	£ s. d.	
Wick, . .	478	three	May	196 0 0	56 0 0	2 13 2	April	May	70 0 0	67 6 10	72 13 2	Boat given up by borrowers.
			1889									
Do. . .	784	seven	Oct.	43 0 0	12 14 10	3 9 8	May	,,	14 5 0	10 15 4	19 9 10	Do. do.
			1888									
Do. . .	343	two	April	125 0 0	28 7 1	8 11 10	,,	,,	36 0 0	27 8 2	69 4 9	Do. do.
			1889				1892					
Stornoway, .	797	six	Dec.	53 0 0	5 6 0	...	March	July	11 0 0	11 0 0	36 14 0	Do. do.
							1893					
Wick . .	499	,,	May	252 0 0	54 0 0	3 9 3	August	September	124 0 0	120 10 9	77 9 3	Do. do.
Do. . .	497	two	,,	252 0 0	73 0 0	3 15 8	September	,,	60 0 0	56 4 4	122 15 8	Do. do.
Orkney, . .	721	one	April	189 0 0	59 1 3	...	October	October	8 10 0	8 10 0	121 8 9	Do. do.
Shetland, .	273	three	March	252 0 0	47 5 0	3 6 6	,,	,,	96 10 0	93 3 6	111 11 6	Do. do.
			1888									
Wick, .	618	two	Nov.	114 0 0	26 18 8	4 12 2	,,	,,	50 0 0	45 7 10	41 13 6	Do. do.
Do. . .	606	eight	Dec.	49 0 0	22 16 10	3 5 9	December	December	15 0 0	11 14 3	14 8 11	Do. do.
Helmsdale, .	592	two	Nov.	124 0 0	33 7 3	0 10 0	November	,,	55 0 0	54 10 0	36 2 9	Do. do.
Totals for year 1893, ...				3,087 18 0	617 4 10	58 6 11			1,159 0 0	1,100 13 1	1,370 0 1	
Totals up to 31st Dec. 1892, . .				6,758 1 9	626 4 5	283 11 6			3,096 0 7	2,812 9 1	3,319 8 3	
Grand totals				9,845 19 9	1,243 9 3	341 18 5			4,255 0 7	3,913 2 2	*4,689 8 4	

Total number of cases in which balances were deemed to constitute bad debts at 31st December 1893, 74.

Note.—The above return does not include arrears of interest due.

* Of this amount Parliament has, under the Public Works Loans Acts of 1892 and 1893, written off £3,965, 16s. 3d., as against the assets of the Local Loans Fund, the sum so written off being apportioned among the different crofting fishery districts as follows:—Helmsdale £63, Lybster £287, 1s. 9d., Wick £1252, 16s. 9d., Shetland £217, 7s. 5d., Stornoway £1518, 9s. 2d., Barra £368, 2s. 7d., and Loch Broom £258, 18s. 7d.

APPENDIX O.

REPORTS FROM THE DIFFERENT FISHERY DISTRICTS.

The following are summaries of reports furnished to the Board by the different fishery officers, showing the state of the fisheries round the coasts throughout the year :—

Eyemouth District.

General condition of the herring fishery.

This industry has been far from producing satisfactory results to curers and fishermen in this district since the year 1884, although the average annual catch has increased, the figures for the last decade being 53,810 crans as against 46,794 crans in the previous decade, the number of boats fishing being 286 and 328 respectively. The development of the industry at various ports on the East Coast of England of recent years has operated in bringing down prices, markets formerly supplied from the district being now largely attended to by English fishermen. The average price of fresh herrings in the district during the past ten years has consequently amounted to only about one-half of what it was for many years previous to 1884.

Means of capture.

The number of first-class fishing boats belonging to the district has gradually decreased from 292 in 1884 to 150 in 1893, and the number of resident fishermen from 1083 in the former year to 974 in the latter, and the number of hired or non-resident fishermen from 472 in 1884 to 96 in 1893. A good many large first-class herring fishing boats were formerly built at Eyemouth and Berwick annually, but this industry is also rapidly declining. In 1884 the value of all boats, nets, and fishing gear in the district was £81,517, whilst in 1893 it was only £43,213. Another result of the unprofitable nature of both the herring and haddock fisheries, of late years, is that the great bulk of the fishing population in the district are finding it extremely difficult to derive a fair livelihood from the produce of the sea, and, consequently, numbers of fishermen along the coast prefer to engage in labouring work on land, whilst many of their sons, when approaching manhood, also prefer similar employment to following the occupation of a fisherman.

Herring fishery of 1893.

The total cure of 52,847 barrels shows a decrease of 10,265 when compared with that of 1892, which year was, however, an unusually productive one, but when compared with the average quantity cured for the preceding ten years, that of 1893 shows only a decrease of 600 barrels. There were 8186 crans despatched from the Scotch stations, nearly all from Eyemouth, in a fresh state, to towns in England and Scotland. This quantity consumed fresh is above the average of some past years for these stations. No doubt the recent extension of the railway to Eyemouth has tended to increase the quantity of herrings forwarded in a fresh condition from that port. From the English section of the district, a few thousand crans of herrings were also despatched in a fresh state to inland towns. They were mostly sent from Berwick.

This fishing commenced at Eyemouth as early as 27th April, and continued until about the middle of July. It was carried on from that station, Berwick, North Sunderland, and Craster. More boats were employed in it than during previous years, the highest number being 69 and the weekly average 44, as compared with 28 in 1892. The fishing was fairly successful, the average catch for the 44 boats being 115 crans against 44 crans in 1892 for 28 boats. The herrings were quite immature, and the size very small, as many as from 1200 to 1600 filling a cran. They, however, sold well, the prices ranging from 3s. to as high as 52s. per cran. The general prices were from 8s. to 30s., and the average price about 17s. per cran. The best week's fishing was that for the week ended 8th July, and the highest individual catch 40 crans. Early herring fishery.

This fishing commenced, as usual, about the middle of July, and finally terminated on the 20th September. The average weekly number of boats employed was 210, and their average catch was 278 crans, as contrasted with 208 boats and an average of 303 crans in 1892, and 209 boats with an average of 213½ crans in 1891. A good regular fishing was got throughout the season. The week ended 12th August was the most productive week of the season, when 215 boats averaged fully 55 crans. The highest individual take for the season was 101 crans, while a great many heavy catches ranging from 60 to 100 crans were landed. The most productive stations were Eyemouth, where 58 boats averaged 381 crans; Craster, 16 boats, average 263 crans; North Sunderland, 70 boats, 251 crans; Berwick, 50 boats, 246 crans; and the smaller stations from 60 to 207 crans per boat. Of the fleet of 210 boats which were employed, about 130 belonged to the district, 50 to Cornwall, and a few to the Isle of Man and to Firth of Forth ports. Summer herring fishing.

During the early herring fishing the boats obtained their catches at varying distances from 8 to 30 miles offshore. With respect to the summer fishing, the boats, up to about the 8th of August, were fishing chiefly off their respective stations at distances varying from 6 to 35 miles, the largest catches being obtained at the more distant offing. From the 10th August until the close of the season, the bulk of the fleet at the different stations were fishing on the grounds extending from off Holy Island to off Dunstanborough Castle, at varying distances of from 3 to 20 miles from land, the most productive grounds being off the Farne Islands, as has been invariably the case at this period of the season. The quality of the herrings was the best obtained for the past two or three years, being very much superior to that of 1892. They were generally strong healthy fish, and were not of an oily nature. Fishing grounds.

As many curers considered it would be unprofitable for them to cure their smallest and very inferior and torn-bellied herrings, they threw them amongst the herring offal for manure. The total quantity of such herrings and of those directly sold by the fishermen for manure is estimated at no less than 2120 crans, while, in addition, there were about 80 crans returned to the sea by the fishermen, for want of purchasers, and on account of the herrings being of extremely poor quality. Herrings for manure.

Prices were not remunerative, the lowest price paid being 2s. Prices.

per cran and the highest 26s. 6d.; the general prices were 5s. to 14s., and the average price for the season was 9s. 6d. per cran, as compared with an average price of 7s. in 1892, 22s. 6d. in 1891, and 12s. 6d. in 1890.

An Eyemouth boat landed the exceptionally large quantity of about 800 crans during the year, and a good many crews secured from 300 to 600 crans each, but, on the other hand, there were a large number that caught only from 120 to 300 crans, who, owing to the low prices obtained, would find the season a poor one, some of them barely clearing expenses. The fishcurers would have a fairly good season, in fact the best for the past two or three years.

There were 6 steam tugs employed towing boats to and from the fishing grounds, as compared with 12 in 1892 and 10 in 1891. These tugs were engaged at from £30 to £40 a week, and each towed five or six boats.

Branding. The total quantity of barrels of herrings branded was 11,431½ as compared with 2249½ barrels in 1892 and 1549 in 1891. This total appears to be the largest recorded for one year in the books of the district. Of the season's branding, only 4203½ barrels were branded at the Scotch stations, whilst 7228 barrels were branded at the English stations of the district. Fully one-half of the total quantity branded consisted of mat full herrings. Such is the general quality of the herrings caught in this district, even in good seasons, that only a small proportion of those branded can receive the "full" brand, the bulk being mat fulls.

Haddock fishery. This industry is of almost equal importance with the herring fishery, but was prosecuted with indifferent success at most of the stations. At the Scotch stations the year's produce and value was the worst for many years past, and certainly the poorest since 1884. There was a general scarcity of haddocks on the coast during a large portion of the year. February, March, and April were the most productive months, this being the period when haddocks come inshore to spawn. The most productive fishing grounds were those on the coast between St Abbs Head and Holy Island, and from 3 to 7 miles from land, but the boats were fishing at certain times of the year at varying distances from 7 to 50 miles offshore, the more distant grounds, where some good catches were obtained, being frequented chiefly in the spring and summer months.

Beam trawling. No trawlers landed fish at any of the Scotch stations of the district, and only two landings were made at the English stations, both of which were made at Berwick by English trawlers.

Crab fishery. This industry is of great importance in the district, and during the spring months gives employment to fully 100 boats, manned by about 370 men. During 1893 the fishing was very productive, that at the Scotch stations being the best since 1885. Notwithstanding this fact, however, the season was not a very remunerative one to the fishermen, owing to the exceptionally bad quality of the crabs caught during the spring and summer months, when the season is at its height, the fish being watery and badly filled and altogether far from satisfactory.

Lobster fishing. This fishing, though not much carried on in the district, was the most productive for a good many years past, the quantity

caught at the Scotch stations being considerably larger than in any year since 1885.

The average earnings of the fishermen at the Scotch stations, for 1893, from the herring, line, and crab and lobster fisheries, may be estimated at only £50 per man, after paying all expenses, and for those at the English stations of the district at about £40 per man. Fishermen's earnings.

Leith District.

The produce of the fisheries of this district for the year shows an increase in the total quantity landed, and also in the total value, when compared with the previous year, the figures being 282,054 cwts. and £119,588 respectively, an increase on 1892 of 45,473¼ cwts. and £2400. Fish landed.

The total value of shell-fish amounted to £9365, showing a decrease of £403, as compared with 1892. Shell-fish.

The total catch amounted to 26,022 crans, being 14,640 crans more than the previous year. During the winter and spring, 18,505 crans were landed,—in early summer 460 crans,—during midsummer 1308 crans,—and in the winter at the end of the year 5749 crans. From 43 to 94 boats were employed at the winter fishery at the beginning of the year,—from 3 to 26 boats in midsummer,—and from 25 to 75 boats were again employed at the winter fishery. About fifteen seaworthy herring boats, belonging chiefly to Newhaven, remained unlaunched and unused during the summer season. Herring fishery.

The herring fishery was carried on very energetically and successfully at the beginning of the year at Newhaven, and at the other stations in the neighbourhood, and herrings continued fairly plentiful on the local grounds till towards the end of February. At this early period the fishermen at Dunbar were rather dilatory in commencing herring fishing, and permitted a good opportunity to pass from lack of energy and promptitude; but, later on, the fishing at this place improved, and by the middle of April a fairly good catch was landed. The winter herrings were fully above the average size, and were of unusually good quality.

The summer herring fishery commenced at Dunbar on the 3rd of July, and was prosecuted in rather a desultory manner till the 9th of September. From the beginning of this season herrings were scarce on all the usual local grounds, but about the end of July they were considered to have been in some abundance on the grounds from 25 to 35 miles eastwards from Dunbar. The greater portion of those landed were caught off the Northumberland coast, and were frequently the surplus of herrings caught for bait. The weather was generally very favourable during the season. The herrings were of rather small size, and of mixed quality, and were more suitable for the purposes of the fresh markets than for curing. Beginning on the 8th July, the weekly average catch for 9 weeks was 23 crans per boat.

The winter herring fishery began, for small herrings and sprats, in the week ended 12th November, when 5 drift and 20 seine-net boats were employed. The seine boats were the more successful till the middle of December; when small herrings and sprats became scarce,

larger herrings appeared, and then the drift boats took the lead. The size of those small herrings,—caught mixed with sprats,—ranged from 1500 to 4000 to the cran, and the quality was inferior,—but the quality and size of the drift-net fish were very satisfactory. The herrings caught at the close of the year were not nearly so good as those caught at the beginning of the year.

Immature herrings.

Large quantities of very small herrings and sprats were caught at Alloa and Kincardine, and were disposed of for manure. During December, fully 2300 cwts. were sold for manure.

Sprats.

The total catch of sprats was 10,524 cwts., valued at £915, showing an increase of 4700 cwts. as compared with 1892, and an increase of only £87 in value. The low value for 1893 was caused by such a large quantity being sold for manure. The principal landings were made at Newhaven, Alloa, Kincardine, Queensferry, Bo'ness, and Inverkeithing.

Haddock, whiting, &c.

The total catch of haddocks amounted to 81,502 cwts. and of whitings to 5705 cwts., showing decreases on the previous year of 6063 cwts. in haddocks and of 1920 cwts. in whiting. The quantities of those fish landed by trawlers were 53,421 cwts. haddock and 3131 cwts. whiting, decreases of 3112 cwts. and of 1537 cwts. respectively, as compared with 1892; the remainder, caught by line, showed decreases of 2951 cwts. haddock, and of 383 cwts. whiting, on the catch of 1892. The catch of line fish has decreased each year since 1890. From the beginning of the year to the middle of March, this fishery was fairly successful. At the latter date, the haddock spawning season was considered to have been prolonged about a fortnight later than was usual in former seasons. From that time fish continued somewhat scarce, until about the middle of June, when immature haddocks of very small size appeared in great numbers on the grounds beyond the May. They soon found their way to the lower and upper waters of the firth, and continued abundant till towards the close of the year.

Large quantities of those small fish were caught both by trawl and by line, and they soon sold at very low prices, or became unsaleable. It was fairly estimated by trawlers themselves, that, in the months of June and July, only from a half to a third of the quantity of haddocks caught by trawl were picked out and brought to market, while the other half or two-thirds of those captured were thrown overboard into the sea as dead offal.

Cod, ling, and Saithe.

The total quantity of cod, ling, and saithe landed amounted to 49,052 cwts., a decrease of 3030 cwts. compared with 1892. Of the gross catch, 26,921 cwts. were caught by line and 22,131 cwts. by trawl,—an increase of 4386 cwts. in trawl fish, but a decrease of 7416 cwts. in line-caught fish.

Fishing grounds.

Line fishermen fishing for haddock, &c. wrought chiefly on the grounds near the Isle of May, and up to 50 miles seawards, while cod-liners wrought up to 190 miles eastward from the May. Trawlers wrought chiefly on the grounds within 40 miles of the May, but several of the larger vessels fished up to, and on, the Dogger-Bank, 160 to 200 miles from the May, and landed heavy catches from those grounds.

Shell-fish.

Of mussels and clams, 36,636 cwts. were landed, a decrease of 4343 cwts. as compared with 1892. Although the demand for

mussels was less than usual last autumn, yet the supply was scarcer than usual, and local opinion is strongly in favour of cultivation, with greater protection of the beds. The import of Dutch mussels, at Leith, amounted to 9054 cwts,—which were all despatched coastwise,—and shows a decrease of 15,417 cwts. on the figures of the previous year.

Of oysters, 71 hundreds more were landed than in 1892; of lobsters, 1754 less; and of crabs, 892 hundreds more.

Beam-trawling. Beam-trawling was carried on throughout the year with fair success. The number of vessels employed was 26, an increase on the previous year of 4 vessels. All those vessels belonged to Granton or Leith.

Loss and damage. Loss and damage amounting to £6730 occurred,—of which £190 was on boats and £6540 on fishing gear. Of the latter sum, the large amount of £5200 was in connection with trawling gear.

Boat building. Boat building was brisker than in 1892; 23 sailing boats, 3 steam-liners, and 3 trawling vessels being constructed. Except the 3 steam-liners, which went to Aberdeen, all the others were for local use. Two steam trawlers,—though not quite new,—were brought here from England.

English and Irish fisheries. As usual, a number of boats belonging to this district fished for herrings at the English and Irish fisheries, and a few boats fished with lines at Shields. Having arranged with a Liverpool firm, 16 boats proceeded to Queenstown early in May, to fish for herrings, and their action practically disposed of the question regarding the commencement of the herring fishery at Kinsale. The Irish fishery was rather unsuccessful last season, and the average earnings of those 16 boats would be about £110, while 9 boats at Kinsale averaged only £80 per boat. In autumn, at Scarborough, 7 boats averaged about £50 in a few weeks, while 10 boats at Yarmouth would average about £130 for the season there.

Railway rates, &c. To show the effect of excessive railway rates upon the fisheries, an actual case may be given, where 30 barrels of sprats were sent to London and were sold there on the 7th December for £12, 10s. The charges were, for carriage £9, 14s. 9d.,—market dues, porterage, &c. £1, and for commission 12s. 6d.,—leaving £1, 2s. 9d. to repay the cost of fish, wages, and cartage to the railway station.

Anstruther District.

The various fisheries in the first half of the year were fairly prosperous, especially the winter herring fishing, the result of which considerably exceeded the combined takes of the three previous seasons. This was followed by a successful spring and summer cod fishing, at which a large number of fishermen and other workers were employed and earned good wages. Fishermen were able to meet current expenses, besides paying off some old liabilities and providing new fishing material. The latter half of the year was disappointing. A few crews who proceeded to the summer herring fishing at northern stations did remarkably well, but the larger number failed to attain their usual success. The herring fishing

at Scarborough, Yarmouth, and Lowestoft was a comparative failure, and very little was done at home in the closing months of the year. At the present time many families are very poor indeed, and dependent on the credit system to tide over present difficulties.

Means of capture.

There has been a steady decrease in the number and value of boats and fishing material in the district since 1886, when it reached its highest point. The disastrous experiences of the trade in 1884 were not felt to their full extent by fishermen until 1886. At that time a retrograde movement set in which has not yet been arrested, and the outlook at present, with comparatively low prices for herring and increased expense in the upkeep of the large boats now indispensable for their capture, leaves little room for indulging in the hope of a speedy recovery. To counteract this downward tendency, a steam line fishing company was formed at Anstruther two and a half years ago, which now owns four boats, while a fisherman owns a fifth. These boats have been fairly successful so far, and have added considerably to the value of fishing material.

The fishing boats belonging to the district number 708, and include 2 steam-trawlers, 6 steam-liners, 414 first-class sailing boats, 181 second-class, and 105 third-class boats. The 2 steam-trawlers and 1 of the steam-liners fish regularly from Aberdeen. When compared with 1892, a decrease of 17 boats, and of £5875 in value, is shown. Carrying the comparison back to 1886, the decrease in the number of boats is 257, and in estimated value £26,315. Taken by itself, this shows a very large decrease in the space of seven years, but it is more significant still when it is observed that in 1886 the estimated value of boats directly owned by fishermen was £85,964, while this year it amounts to only £47,149. None of the fishermen, except the one previously mentioned, holds any shares in trawlers or steam-liners. A somewhat similar reduction has taken place in the value of fishing gear, which stands this year at £84,080, as compared with £113,716 in 1886.

Fully a third of the herring boats are provided with bush-ropes, and this system of fishing is likely to become general.

Fish landed.

The whole of the fish landed in the district were caught by net and line, and amounted to 192,182 cwts. Of that quantity, 7788 cwts. of herring were used for bait at sea. The total value amounted to £51,939, or, including shell-fish, £59,435.

Herrings.

Of the herrings landed, the winter herring fishing yielded 82,288 cwts. The remainder were caught during the spring and summer. The winter herring fleet numbered 101 boats, and the fishing ground was confined to the Firth of Forth. In summer, 345 boats were fitted out for the herring fishery, 71 of which fished at Shields, and the remainder at northern Scottish ports. The summer-caught herrings were chiefly brought from the Aberdeen grounds by district boats fishing there, who sometimes found it more convenient to reach Anstruther than Aberdeen. No herrings were caught in the Firth of Forth in summer. This is the more remarkable seeing that so many were caught there in winter.

Cod and ling.

The cod and ling, &c. fishing is next in importance, and employed 112 boats, including 5 steamers, from April to June. The crews

numbered 793 men. The fishing ground was over the North Sea, generally as far out as 200 miles eastward of the May Island.

Haddock and whiting.

The quantity of haddocks and whiting landed are less than those for 1892 by 6328 cwts. and 713 cwts., and £3006 and £279 respectively.

The great bulk of the fish was caught in and about the Firth of Forth and Bellrock grounds, and were landed, as a rule, early on the day of capture, and usually brought high prices.

In common with the general experience round the East Coast of Scotland, large quantities of small haddocks were caught on the inshore grounds from the month of May onward. These found a market amongst the coast and inland towns of the district at low prices.

Flounders.

Compared with the preceding year, flounders show an increase of 410 cwts. and £332 in value. St Andrews contributed fully a half of the total catch, and Largo fully one-fourth. There were caught at Elie, during the summer months, 207 cwts. of sand-eel, for bait purposes, which were valued at £90.

Sand-eels.

The haddock and flounder fishing employed, for a great part of the year, 16 large boats and about 70 yawls, manned by about 440 men.

Sparlings and sprats.

The sparling and sprat fishing in the Tay, at which 30 boats and 90 men were employed, yielded 297 cwts. sparling, valued at £1173, and 1000 cwts. sprats, valued at £37, the latter being used as manure. Besides these, there were caught in the sparling bag-nets 86 cwts. flounder and 36 cwts. eel, which valued £93 and £86 respectively. Both the flounder and eel are fresh-water fish, and command high prices. The latter, together with sparlings, are usually sent to market by the fishermen themselves, in small boxes containing 3 lbs. of fish. The time during which fishermen are allowed to fish in the Tay extends from the 25th September till the 24th February. Newburgh fishermen only carry on this fishing, and while not so employed are salmon fishers.

The value of shell-fish landed exhibited a decrease, when compared with 1892, of £1650. This decrease was nearly all in crabs and lobsters. Crabs showed a decrease of 303 hundreds in number and of £1016 in value, caused by the prevailing poor quality and consequent low prices. The number of lobsters caught was 215 hundreds, valued at £638, as compared with 314 hundreds and £1180 in the preceding year. Mussels and other shell-fish remained almost stationary. Steam has been applied to mussel-dredgers at Tayport, 4 small vessels being at work there.

Fish cured.
Herring.

It is a remarkable fact that, although over 24,000 crans of herrings were caught in the Firth of Forth in winter, none were found there in summer. This is no isolated experience, but has been the same, more or less, for a period of years. The district is very much deserted in summer by fishermen and others connected with the trade, who go elsewhere. As a consequence, herring curing has become almost a thing of the past. During the year, 3267 barrels were cured gutted, 1080 barrels cured ungutted, 202 crans were kippered and 3577 were bloatered. These latter were nearly all cured in the winter season. Ungutted herrings were chiefly smoked afterwards, but part of them were sent to Ireland in pickle

during the winter season. Small consignments were sent to the Continent via Leith.

Cod and ling, &c.

The curing of cod and ling was carried on extensively in summer. The total quantity cured was about one-third greater than in any previous year, and reached a total of 342,769 fish, equal to 14,644 cwts. cured dried, and 39 barrels in pickle. These figures are an increase on 1892 of 98,667 fish, equal to 3644 cwts. dried, but a decrease of 54 barrels cured in pickle. The demand for cured fish was brisk in the beginning of the season, and prices opened at £18 to £19, 10s. per ton. As the season advanced, the demand slackened, and lower prices had to be accepted. Curers complained that the season would be an unprofitable one for them, a few of them having balances of last season's cure still on hand unsold. There were no cured codfish exported direct from the district.

Of the district boats which fished at English ports during part of the year, 71 fished for herrings at Shields from May to September, 60 at Scarborough at the end of September and October, and 52 a little later at Yarmouth and Lowestoft. The estimated earnings of the Shields boats were £27,690, or an average of £390 per boat. Those at Scarborough grossed £3835, an average of nearly £64 per boat, while the Yarmouth and Lowestoft boats were estimated to earn £4295, or nearly £83 per boat. A few boats in spring, and steam-liners in August and following months, frequented Shields for the sale of white fish, the proceeds being estimated at £500.

arrel-making.

Barrel-making was brisk during the year, and all available hands were fully employed. Barrels were made chiefly for sale to other stations, who depend partly on getting supplies from this district, and manufacturers find markets for them in most parts of Scotland, as well as in England and Ireland.

Boat builders would have been practically idle, had it not been for orders for steam-liners. Of this class of fishing craft, 2 were launched at Anstruther for local companies, 1 was launched at Pittenweem for Shields owners, and 3 at St Monance,—2 of them for Aberdeen and 1 for Shields. A small steamer was also built at Anstruther for mussel-dredging at Tayport. No ordinary first-class boats were built, but six second-class yawls were sold. A large boat is on the stocks here, at present, to replace a boat which was sold to Peterhead.

Under the auspices of the County Council, a navigation class was again started in St Monance this winter, but it has not been so well attended as it ought to be.

Montrose District.

The most important winter and spring fishery is that of the haddock, and the district, which extends only about 30 miles in length, fitted out 230 boats (exclusive of trawlers) in 1893, manned by 930 fishermen, for the capture of these fish. It is to be regretted, however, that a serious diminution is yearly taking place in the quantity landed, which is seriously affecting the material prosperity of the fishermen engaged. In 1892 a decrease of 6512 cwts. of

haddocks was reported, while in 1893 the decrease, although not quite so large, amounted to 3741 cwts., and if haddocks taken by trawlers are excluded, the decrease upon those caught by line would amount to 4831 cwts. The season was remarkable for the presence of a great number of small haddocks on the coast and the unusual scarcity of large-sized fish. From the beginning of May to the end of the year two-thirds of the catches landed by the line fishermen consisted of fish of so small a size as to render them almost unsaleable. In the beginning of May they varied in length from 4 to 6 inches, while at the end of the year they had not grown more than 2 or 3 inches. The quantities captured bore a very small ratio to the vast shoals observed off the coast. An idea of their extent may be gained when it is stated that on one occasion a trawler happened to cast the trawl in the midst of a shoal of these small haddocks and brought on board about ten tons in two drags; but on the size of the fish being observed, they were let free. It is not known whether this occurred frequently among trawlers, but if it did, great care was taken not to bring many of these small fish ashore.

Herring fishing.

Notwithstanding the agitation that has been going on for a close time for the past two years, the summer herring fishing began three weeks earlier than in any previous season. In the middle of June, however, the herrings were so poor in quality as to be unfit for curing, but during the exceptionally warm weather experienced they rapidly grew, and in the course of a fortnight a large portion of the catches had attained full size and maturity, and were spawning at such an unusually early period as the end of July.

From 24 to 34 miles from land lies a bank, stretching out from Bervie to the Bell Rock, known as the 'Second Reef.' This was where the summer herring fishing began, and this was where it was prosecuted till the end of the season, owing to the abundance of fish found on it; the more favourite ground of previous years, lying about 15 miles offshore, known as the 'First Reef' or 'Shauld Water,' being almost entirely neglected. So prolific were the shoals that some of the boats landed upwards of 460 crans in 8 successive shots, the average for the Montrose boats being 340 crans and for the district 267. The quality of the herrings was superior to that of those taken in 1892.

Only 24 Montrose crews entered into agreement with fishcurers to land a complement of 250 crans at 13s. per cran, and £5 bounty each crew, 16 Arbroath crews following their example. Sales by auction were carried on at Gourdon and Montrose. The prices at these sales ranged from 5s. to 16s. per cran, the average price being 11s. per cran.

Owing to the great reduction in the price of herrings, from 25s. to 11s. per cran, during the past few years almost the whole of the fishermen's earnings are required for the purchase of new nets and to repair the wear and tear of other fishing material. The large and superior herring boats purchased by the fishermen in 1884 and 1885 are now getting old and worn out, and when they become unseaworthy they are not replaced for want of funds. For instance, at Auchmithie, where 6 boats used to be fitted out for the herring fishery, in 1893 four were left on the beach as being unseaworthy,

and the crews were obliged to proceed to the stations of Peterhead and Fraserburgh as hired hands. A number of the younger fishermen are also engaging in shore occupations on account of the unremunerative character of the fishing.

Trawling.

Beam trawling is not making much progress in this district. For the past few years the number of vessels belonging to the district has varied from 4 to 6, and in 1893 there was one less than in the preceding year. The grounds off this coast have, however, been continuously fished by a large number of Aberdeen trawlers.

Means of capture.

With the exception of two English trawlers, which landed their takes at Dundee, all the boats and vessels employed in the different branches of the fisheries in Montrose district belonged exclusively to Scotland. Only during the herring season did a few boats from other districts occasionally put in to Montrose with their catches. The total number of boats employed was 609. Of these 379 were engaged with drift-nets and long lines, 7 with the beam trawl, and the remainder in crab and lobster fishing, all being propelled by sails or oars, except the 7 vessels engaged in trawling, which were steamers.

Fish landed.

The quantity and value of fish landed showed a decrease from 1892 of 13,838 cwts. and £7347 respectively; but an increase of 5214 cwts. in the catch and a decrease in value of £2860, as compared with the average for the three preceding years.

While the quantity and value of the fish taken by net and line showed a decrease of 15,485 cwts. and £8182 respectively, the returns of fish landed by trawlers increased to the extent of 1647 cwts. and £835. The rates per cwt. for fish caught by net, line, and trawl respectively were 3s. 1½d., 10s. 9d., and 12s. The proportions of the catch landed by net, line, and trawl were 141,560, 85,045, and 22,806 cwts. respectively, giving an average for each boat engaged in the net and line fishing of 598 cwts., and for each trawler, of 3258 cwts.

The catch of haddocks exhibited a decrease as compared with 1892 of 3741 cwts. in quantity and £4675 in value.

The bulk of the catch of cod consisted of codling caught in the inshore waters by small line boats, which engaged also in haddock fishing, the returns of the deep-sea cod and ling fishing being the poorest for a number of years. The total quantity and value landed amounted to 20,881 cwts. and £7256 respectively, as against 13,655 cwts. and £4308 in 1892, the average price being 7s. per cwt.

Of the different kinds of flat fish landed, flounders, plaice, and brill, contributed most largely to the catch. The quantity and value exhibited a slight decrease as compared with the preceding year. Fully one-half of the catch was taken by trawlers, and realised nearly 20s. per cwt., while those caught by line realised only 9s. 11d. This disparity in the price is accounted for by the trawlers capturing all the brill, which are far more valuable from a commercial point of view than flounders and plaice.

The returns of halibut landed were only about one-half of those for 1892, while the quantity of skate taken decreased from 2016 cwts., valued at £289 in 1892, to 812 cwts., valued at £199. The

fish included under 'other kinds' consist chiefly of hake, gurnard, and cat-fish.

The highest average price obtained for any kind of fish was £3, 6s. 2d. per cwt. received for turbot landed by trawlers.

There is a slight increase on 1892 in the sprat, sparling, and mackerel fishing, and also in the round fish, which include cod, ling, saithe, haddock, whiting, and conger eel, the figures for the latter kinds being 97,324 cwts. as compared with 89,030 cwts. in the preceding year. This is accounted for by the codlings being in 1893 included with cod, while previously they were given under 'other kinds.' Haddocks, cod, and whiting, in the order given, contributed the bulk of the returns of round fish.

Flat fish showed a decrease of 279 cwts. in the catch and an increase of £246 in the value as compared with 1892. The kinds which contributed most largely to the returns were flounders, plaice, and turbot.

Fishing grounds.

The grounds on which the haddocks, codling, and whiting were got were situated from 6 to 20 and from 30 to 60 miles from land, embracing the area from Bervie to beyond the Bell Rock. Turbot, lemon sole, plaice, and brill were taken chiefly from 30 to 50 miles E. and S.E. of Montrose, while most of the flounders were taken from St Andrews Bay.

Earnings of fishermen.

The average earnings of the fishermen engaged in net and line and lobster and crab fishing was £61 for the year. Included among the net and line fishermen are about 80 men who engage in salmon fishing for six months of the year; but their earnings during that period are not taken into account. The value of the fish landed in England by the district boats would not amount to more than 10s. per man.

Shell-fish.

There is a decrease of £417 in the value of the shell-fish taken as compared with 1892, which is accounted for by the lobster and crab fishery. An increase of 2363 cwts. is shown in the quantity of mussels, and consequently only a small proportion of the amount required for bait had to be imported from Holland.

Fish sold for use in a fresh state.

The statistics of fish used fresh show that there is a decrease from 1892 of 7400 cwts. in the quantity and £5221 in the value. Only about one-twentieth of the herrings taken were used fresh, but all the other different kinds of fish were disposed of in this manner, excepting a small proportion of cod, ling, and saithe.

Fish cured.

A remarkable feature of the herring-curing industry in the district of recent years is, that while a gradual increase is observed in the number of barrels cured, the number of curers engaged is falling away. The welfare of the industry was seriously affected by a strike among the gutters and packers during the most successful week of the summer season, in consequence of which a large quantity of herrings was disqualified from receiving the official brand. The quantity cured shows an increase on 1892 of 6141 barrels.

Cod, ling, and hake.

The cod, ling, and hake curing industry is becoming a thing of the past as far as this district is concerned. It is dwindling away year by year, and only a small proportion of the catch is now cured, and that for local dealers. The total number of fish cured was 23,552, equal to 724 cwts. dried, against 2210½ cwts. in 1892.

Herrings exported.

With the exception of about 200 barrels disposed of in the district, the total quantity cured was exported. The herrings sent from the district to America came, in the first instance, from Peterhead, and were exported from Dundee.

Stonehaven District.

Introductory statement.

In Stonehaven district the prosecution of the different branches of the fishing industry was, in so far as regards quantity landed, attended with better results than in the preceding year,—the returns of white fish showing an excess of upwards of 5900 cwts. In the gross value of all the fish brought ashore, however, there was a decrease of more than £1500; and, indeed, the financial returns for the year were the lowest recorded since the collection of fresh fish statistics was begun. Contrasted with the average yield of the previous nine years, the returns for 1893 exhibit a decrease of 8800 cwts. in the quantity of white fish, and of £4955 in the gross total value of all fish landed.

The principal varieties of fish caught were herrings, haddocks, whitings, cod, ling, saithe, and crabs.

Means of capture.

In 1893 the resident fishermen and boys numbered 15 fewer than in the preceding year; there was a shortcoming of 8 in the number of boats; while the values of boats and of fishing gear showed decreases of £572 and £715 respectively.

The falling off in the number of men and the number and value of boats is due to the removal of fishermen from some of the smaller creeks to more important fishing centres; while the diminished value of fishing gear is partly explained by the fact that the boats employed in the summer herring fishing have reduced their fleets of nets, chiefly with the view of enabling them to reach harbour with their catches before the departure of the earlier trains for the south, and so secure enhanced prices.

There are no beam-trawlers or boats propelled by steam belonging to the district. The only modification in the instruments of capture consisted in the adoption by a few crews of the 'bush-rope' in drift-net fishing; and so generally was its use approved of, that many more are likely to be introduced this year.

Fish landed.

While the total quantity of white fish landed during the year amounted to 5927½ cwts. more than in 1892, it realised £1510 less.

The summer herring fishing, which opened on 1st July and closed on 30th August, proved the most productive since 1889 It yielded 5082 cwts. more than in 1892, and an increase of 6749 cwts. over the average of the preceding decennial period From about the middle of July to the 5th of August the fishing was prosecuted with remarkable success. Thereafter, however, the catches were generally light and partial. Indeed, throughout the season the takes were very irregularly distributed.

The fishing grounds extended from about 6 to 40 miles distant; but comparatively few herrings were caught beyond 20 miles. The best takes, and the bulk of the catch, were obtained at from 6 to 15 miles S. and S.E. from Stonehaven, an area

on which herrings make their appearance, for the purpose of spawning, with great regularity. The quality of the herrings, generally, was very good, and much superior to that of those caught in 1892.

Haddock and whiting fishing.

From a monetary point of view, the haddock and whiting fishing was the most important in the district. It was prosecuted more or less throughout the year; but what may be termed the regular season extended from January to the end of June, and from September till the close of the year. As compared with 1892, the haddocks landed show an increase in quantity of 1911 cwts., but a diminished value to the extent of £1023, equivalent to a fall of 2s. 1½d. per cwt. The decrease in value was entirely owing to the unusual abundance on the coast, between June and November, of small-sized and inferior haddocks, which were frequently sold at from 9d. to 1s. per cwt., while occasionally it was found impossible to dispose of them at any price.

During the first two and the last three months of the year, the principal fishing grounds extended from about 1 mile to 5 miles off, and in March from 10 to 20 miles; while during April, May, and June those grounds lying at a distance of from 30 to 70 miles were chiefly resorted to, but proved much less prolific than in former years. February, March, and October yielded by far the best results, and the quality of the February and March fish was superior. The whitings landed gave, as compared with 1892, 872 cwts. less in quantity, and a reduction in value of £292, but an increase of 1s. 8¼d. per cwt.

Cod and ling fishing.

The principal cod and ling fishing began in April, and continued till the end of June; while crab creels were set from March to October. When contrasted with the returns of 1892, the fish brought ashore represents 1425 cwts. less in quantity, a diminution of £621 in value, and 4¾d. less per cwt. In winter operations were confined entirely to the territorial waters. From April to June the boats fished from about 80 to 160 miles from land; and those crews who were fortunate enough to procure a good supply of herring bait, generally secured excellent hauls of large fish on the distant fishing grounds.

The catch of eels amounted to 120 cwts., valued at £80, against 104 cwts., valued at £59 in 1892. Nearly all those landed were caught during the winter months in the territorial waters.

In comparison with 1892, the flat fish landed show an increase of 92 cwts. in quantity and £32 in value. They consisted chiefly of flounders, which were generally of small size, and all caught on the haddock lines.

The total value of shell-fish taken shows a decrease of £30 as compared with the returns for 1892. The species which contributed most largely to the catch was the crab, which shows, when brought into contrast with the figures of 1892, a slight increase in the number landed, but a diminution in the value.

Owing to the low prices paid for the summer-caught herrings and for the haddocks landed between June and December, the year's earnings of many of the fishermen were very small, and not a few of them and their families are in somewhat straitened

circumstances. The gross average earnings per man for the year are estimated not to exceed £50.

Fish sold for use in a fresh state.

In the total quantity of white fish used fresh there was an increase of 1773 cwts. over the returns of 1892, but a decrease of £1530 in value. Included in the above, however, are 12,293 cwts. of haddocks (valued at £10,654), the estimated quantity cured smoked during the year.

With the exception of 421 cwts. cured dried, all the cod, ling, and saithe caught were used fresh; as were also 11,537 cwts. of herrings as against 10,010 cwts. of herrings so used in 1892.

Fish cured. Herrings.

Compared with 1892, there were 1970 more barrels of herrings cured gutted, 149 less barrels ungutted, and a diminution in the herrings kippered of 241 barrels. All the herrings were cured on shore, and as they were generally delivered in good condition, and early in the day, they could not fail to give satisfaction to the consumers. Eleven curers were engaged in the trade.

Cod, ling, and hake.

The quantity of cod, ling, and hake cured was about the same as in the previous year.

Herrings branded.

The number of barrels of herrings which received the official brand shows an increase of 2719 over the number branded in 1892. There was a decrease in the number of barrels stamped "Matfull" and "Mixed," but an increase in the number to which the Full and Spent irons were applied. Three hundred and seventy-eight barrels were found to be unworthy of the brand.

Herrings exported.

The herrings exported direct from the district showed an increase of 980 barrels as compared with the figures of 1892. Besides these, a considerable number of barrels were sent to Leith and Aberdeen for export. Of the herrings exported direct, there was an increase of 1149 in the number of barrels sent to Russian ports, but a reduction of 169 in those shipped for ports in Germany.

General remarks.

The weather during the year was, on the whole, remarkably fine. There was no loss of life in connection with the fisheries; while the total loss of fishing gear, and damage to boats, was comparatively small, amounting to £386, against £762 in 1892.

Four haddock boats were built, of an aggregate value of £238. They were full decked, and ranged from 25 to 36 feet keel.

Aberdeen District.

During the year the different fishings of the district were prosecuted, as usual, with much perseverance and energy. The herring catch proved the highest on record; the beam-trawlers yielded a comparative increase in the quantity and value of fish landed, as likewise did the great-liners, but the small-line fishing, which gave average returns up till the month of May, for the remainder of the season was unsuccessful, most of the haddocks taken from July to the end of the year being unusually small in size, and hence of little value.

Herring fishery.

The summer herring fishing was regularly prosecuted by 345 boats, of which 324 were Scottish, 5 English, 8 Irish, and 8 Manx. A commencement was made on the 1st of July by a larger number of boats than usual at that early date. Herrings were

abundant on the principal fishing grounds, which lay distant 12 to 45 miles E.S.E. to S.E. from Aberdeen. It proved a successful season. The quality was generally good. The yield amounted to 114,614 crans against 106,432 crans in 1892. The fishermen obtained fair prices, the average for the season being about 10s. 1½d. per cran. No boats were engaged by the curers, who obtained better results than for several years.

The catch for the month of July was 65,955 crans; for August, 47,329; and for September, 1330. The highest take for the season for one crew was about 850 crans, and the largest single take was 150¾ crans. The most successful week of the season was that ended the 29th of July with a yield of 25,974 crans.

The weather was favourable, apart from occasional high winds and calms and fogs. There was no loss of life. One boat with a large catch of herrings was totally wrecked in the entrance channel to Aberdeen Harbour, otherwise the damage to boats was of small account, and the loss and damage of nets was comparatively light and principally caused by the nets sinking overweighted with herrings.

The quantity cured in barrels showed an increase over 1892 of 13,165 barrels, while the quantity kippered and made into reds and bloaters increased by 5820 crans, and that used fresh by 1500 crans.

The total quantity branded exhibited an increase of 25,850½ barrels, and of brand fees collected £430, 16s. 10d. The increase is accounted for by the superior quality of the herrings landed in 1893.

Apart from the quantity exported direct, a good many barrels were sent coastwise to Leith for shipment to the Continent, &c., and quantities of barrels, half barrels, and kegs, &c., were sent by railway to Glasgow for shipment there to New York and other places out of Europe; and the balance on hand at the close of the year was only about 700 barrels, which may also be exported.

The winter, spring, and early summer herring fishings yielded 3367 crans as against 904 crans in 1892, making a total catch for the year of 117,981 crans against 107,336 crans in 1892.

Beam-trawling.

During the year 131 beam-trawl vessels landed fish at Aberdeen, of which 38 belonged to Aberdeen, and 81 were English and 50 Scottish, 124 of them being propelled by steam and 7 by sails. The number fishing regularly from Aberdeen was 37 English and 42 Scottish, all steam-trawlers; and as regards the other 52 which landed fish during the year, 14 fished for certain periods of the year from Aberdeen and 38 came in only occasionally. The total arrivals made by trawl-vessels with fish amounted to 4096, against 3858 in 1892. The principal fishing grounds, so far as known, lay offshore 5 to 100 miles north and south along the coast from Aberdeen, in and through the Pentland Firth, and on the Fisher and Dogger Banks. Also in May and June, 13 of the first-class trawl-steamers extended their trawling operations even so far distant from Aberdeen as Iceland, where they found haddocks, plaice, witch, megrim, halibut, dabs, whiting, skate, cod, ling, &c., abundant, obtaining large quantities, but unfortunately the quality of the fish proved unsuitable for the fresh market, being generally

inferior, and very low prices were realised, and hence the venture in view of its great expense had for the time being to be abandoned as unremunerative, but this summer another trial at Iceland is likely to be made.

The following is a comparative statement of the quantity and value of the principal kinds of fish landed by the trawlers during each of the two years, 1892 and 1893 :—

Kinds.	Year 1892.		Year 1893.	
	Cwts.	Value.	Cwts.	Value.
		£		£
Cod, ...	20,779	10,151	28,006	12,127
Haddock, ...	141,341	81,408	176,264	110,762
Whiting, ...	2,281	1,204	3,845	2,144
Turbot, ...	2,480	9,728	2,527	9,316
Sole (Lemon Sole), . .	18,355	30,200	12,833	21,810
Flounder, Plaice, Brill, .	30,115	33,869	36,789	36,574
Other kinds of White Fish,	24,854	5,421	22,457	5,543
	240,205	171,981	282,721	198,276

The returns show an increased catch over 1892 by trawlers in cod, ling, tusk, saithe, and hake, haddock, whiting, turbot, halibut, and flounder, brill, plaice ; but a decrease in lemon sole, eel, skate, and other kinds of white fish. The largest individual take landed, consisting mostly of haddocks, realised £284, while the most valuable catch, composed principally of plaice, brought £354. The Iceland fish landed, from the 27 voyages made, realised £2340, the average being only £86 per voyage. The average quantity and value of fish landed from each voyage by trawlers in 1893 was respectively 71 cwts., value £49, 2s. 5d., as against 63·66 cwts., value £45, in 1892.

Great-line fishery.

In the course of the year 266 boats were engaged in the prosecution of this fishing and landed fish at Aberdeen : 215 being Scottish and 51 English, manned by about 1964 fishermen and boys. Sixty of these were steam boats and 206 sailing boats, of which 26 were welled smacks ; and 28 belonged to the district—17 steam and 11 sailing boats. The 266 boats made 2453 arrivals.

The great-line season—April, May, and June—yielded more than an average catch, which realised good prices, while 18 steam liners which continued fishing throughout the year did fairly well. A few trials were made on the Faroe fishing grounds without success, the fish being scarce.

The principal fishing grounds during the summer season lay 150 to 230 miles N.E. by E. distant from Aberdeen, but during the rest of the year the steam-liners fished off this coast chiefly, from 10 to 50 miles offshore, and occasionally in the Moray Firth.

Small-line fishery.

This fishing employed in the course of the year 168 boats, of which 25 prosecuted the deep-sea haddock fishing during the months of April, May, and June with rather poor success. The

yield for the year fell short of an average catch, and was remarkable for the unusually large quantity of small-sized haddocks which were caught and which were of little value.

The following comparative statement shows the different kinds of great and small line fish landed in the district and their value respectively for the last two years:—

Kinds.	Year 1892.		Year 1893.	
	Cwts.	Value.	Cwts.	Value.
		£		£
Cod,	38,803	19,655	44,081	22,171
Ling,	9,749	4,101	14,889	5,228
Saithe and Hake,	5,389	693	6,204	740
Haddock,	37,039	22,042	37,097	20,773
Whiting,	7,115	4,386	5,996	4,676
Halibut,	11,483	13,639	9,484	10,846
Skate,	6,613	1,527	9,342	1,756
Other kinds of White Fish,	3,434	888	4,753	1,024
	119,625	66,931	131,846	67,214

The returns of the trawl and line fishings show an increase in quantity and value over 1892 of 58,184 cwts. and £27,833. The increase in quantity is in cod, ling, tusk, saithe and hake, haddock, whiting, turbot, flounder, plaice, brill, eel, and skate; but a decrease in halibut, lemon sole, and other kinds of white fish.

Shell-fish.

This fishing is confined in this district to lobsters and crabs. The number of lobsters landed in 1893 amounted to 650, valued at £28, against 870, value £47, in 1892, and crabs 32,700, valued at £296, against 35,970, value £391, in 1892; showing a decrease in the value of shell-fish of £114.

The aggregate value, fresh, of white and shell fish landed during the year, including herring, amounted to £330,098, against £288,048, in 1892.

Casualties.

The 17 lives lost during the year were all in connection with the beam-trawl fishing.

Three steam-trawl vessels, 1 sail herring boat, and 1 sail line boat, estimated value £7975, were totally wrecked.

Boats constructed.

Three steam-trawl vessels were built in the district during the year, and all of them registered at English ports, but 2 of them fished regularly from Aberdeen and the other one occasionally. Five first-class sail-line boats wers built, all for Scotland—3 of them for the district. The 3 trawlers cost £12,700 and the 5 boats £450.

Four new steam-line boats, built out of the district, were added to the Aberdeen fishing fleet, making 13 steam-liners belonging to the port, while 3 steam-liners were in course of construction at and for Aberdeen.

Peterhead District.

General remarks.

Although with succeeding years more energy is displayed in the prosecution of the fisheries, and greater effectiveness attained in the instruments of capture, the leading characteristics of the industry remain unchanged. The modes of fishing continue practically the same as in the past, viz., by nets and lines; but a larger class of boats is being introduced into the herring and white fisheries, and the material now in use is of the finest quality. The scarcity of fish on the inshore grounds has compelled fishermen to go farther and farther from land; and to do so with a minimum of danger, large and well-found boats have become indispensable.

Herring fishing.

So far as the herring fishing is concerned, the season of 1893 was perhaps the most successful on record. The weather was exceptionally good, there having been only one night from the 1st of July to the 19th of September on which no boats could get to sea. The very fine spring had the effect of bringing the herrings to maturity sooner than usual, and this led to an early prosecution of the fishing, as many as 300 boats having been working from Peterhead in June, and these continued to increase until they numbered 527, for which full dues were paid during the season. The quality of the catch was superior to that of average seasons, there having been a large proportion of full fish. The boats hailed chiefly from the following places, viz., 199 from Peterhead, 154 from Banff, 104 from Kirkcaldy, 28 from Inverness, 14 from Leith, &c. On an average about 50 boats fished from Boddam, which made a total for the district of 577. The boats engaged in the herring fishing carry from 50 to 70 cotton nets each, and from 6 to 8 men and boys are employed in each boat. Of late years a bush-rope has formed part of the fishing equipment of the larger-sized boats, this being a strong rope running along the whole drift of nets, and to which the foot or lower portion of the nets is attached. The belief is that this rope, by keeping the nets together (thereby forming a perpendicular wall in the water), increases their effectiveness as engines of capture. The average gross take obtained by the boats fishing from Peterhead amounted to 357 crans, and from Boddam 174, or 342 crans for the 577 boats employed in the district. A number of crews landed from 400 to 900 crans each, but in some cases the figures did not reach 200 crans. The fishermen hailing from other localities were generally the most successful. The two most productive weeks of the season were those ended 8th and 22nd July, in each of which the catch exceeded 30,000 crans. On the 7th of July there was an average of 40 crans for 470 boats, or a total of 19,000 crans, being the largest quantity landed on one day during the season. On the 17th of August 181 crans were landed from one boat, being, so far as could be ascertained, the largest individual take ever brought ashore on the east coast of Scotland. On the day in question, 8 boats averaged the high figure of 124 crans. The bulk of the catch was obtained within 20 miles from land, but some good takes were secured at from 30 to 50 miles out. When the

herrings were on the inshore grounds a considerable loss of nets was sustained through fouling and sinking from weight of fish.

Curing for exportation began on 14th June, and shortly afterwards it became general, this being the earliest date on which a general commencement was ever made in the district. At one time the season gave promise of proving the most profitable the fishcurers had experienced for a decade. The prices of fresh herrings were unusually low, while the quality was superior, the proportion of fulls being far above the average. Prices of cured full herrings during the greater part of the season ranged from 22s. to 24s. per barrel, but towards the end of the fishing the demand became slack and little business was done. At this time fishcurers had large stocks on hand, and there was a general opinion that prices would recover from any slight fall they might sustain, as 22s. was a moderate price for a barrel of crown fulls. But instead of prices rising there was a continuous downward tendency, until latterly some sales took place at the low figure of 17s. 6d. per barrel. This fall in prices told specially against Peterhead curers, as the stocks held by them when prices fell were proportionally larger than at most other stations; so that what promised at one time to be a good season, resulted in barely covering the expenses of many of those engaged in the industry.

Line fishin .

The boats engaged in the great line fishing are the largest-sized herring boats, and the crew of each boat consists of 6 men, with a man or boy for cooking. In the winter season they carry from 2 to 4 lines for each man, but in the spring and early summer sometimes as many as 5 and 6. The lines consist of 7 strings of 70 fathoms each. In the winter season the fishing is carried on at no great distance from land, but in the spring the boats go from 100 to 160 miles, the largest takes being generally got farthest from land, on grounds comparatively seldom fished. Herring is the bait chiefly used. The officer has suggested to some of the local fishermen the use of floats, which would keep the bait suspended a short distance from the bottom, where it would more readily be observed by fish; but they are slow to adopt any departure from the ordinary mode of fishing. The haddock boats have generally 5 men in each boat, and carry one line for each man. The lines consist of from 6 to 9 strings of 70 fathoms each, and the material is much lighter and finer than that used for great lines. The ordinary price of either a great or small line ranges from 35s. to 45s. Mussels form the staple bait in haddock fishing, but a substitute is occasionally found in herrings. All the boats fish along the coast, and generally within a distance of 20 miles from land. Haddocks (which appear to feed chiefly at the bottom) take the bait most readily early in the morning; and the largest hauls are generally obtained in the early months of each year, when the fish congregate in shoals for spawning purposes.

Fish landed

During the past few seasons an increased number of boats have been employed in the line fishing; but the proportionate catch has diminished rather than increased. A hard bottom seems to be most frequented by cod and haddocks, which are to a great extent ground feeders. Halibut, on the other hand, are got in

most abundance on sloping ground on the side of banks; while skate are generally found in greatest numbers in the hollows or deep water. Eel fishing is most successful close to land, and whitings and flounders favour a sandy bottom. It is difficult to compute the average earnings of fishermen, the takes of two boats seldom being alike. The gross earnings during the herring season of 1893 averaged about £30 per man; the great line fishing yielded about £25; while £33 might be quoted as the returns from the haddock fishing.

Fish sold for use fresh.

In the early part of the herring fishing season a considerable quantity of herrings is sent to the home markets in dry ware barrels and boxes, either in a fresh state or slightly sprinkled with salt. The average price of fresh herrings in June was 10s. 5d., in July 12s. 10d., in August 12s. 2d., and in September 13s. 8d. per cran; while 12s. 6d. was the ruling quotation from the 1st of June to the end of the summer fishing. Nearly all the cod and ling brought ashore in winter, and the eels, skate, turbot, and halibut landed during the year, are placed on the markets in a fresh state. In the spring and summer months the most of the cod, ling, and saithe are cured dried, the fish when landed being frequently found unsuitable for the fresh markets. Some haddocks are sent to Glasgow and other places in a fresh state, but the quantity is small. The prices of cod and ling during 1893 ranged from 6d. to 4s. each, according to the size and quality of the fish, and the season of the year. Large haddocks sold from 8s. to 26s. and small from 1s. 6d. to 10s. per cwt. There is a growing demand in the home markets for fresh fish, and with reduced railway rates the consumption could be largely increased.

Fish cured.

Nearly all the herrings landed are cured for exportation, the quantity freshed or kippered constituting a small proportion of the whole. Kippering is, however, extending yearly, this being a mode of preparing herrings for the home markets which is greatly appreciated. For the continental markets the herrings are all gutted and salted in barrels, and great attention is now devoted to the curing, with the view of meeting the taste of the consumers. There were cured gutted, 260,780 barrels; ungutted, 9; kippered, 18,263; converted into reds, 430; and tinned, 673,—making a total of 280,155 barrels against a total of 228,835 in 1892. Of cod, ling, &c., 4000 cwts. were cured dried, this quantity representing 86,677 fish. The great bulk of the haddocks landed are split, dipped in pickle, and slightly smoked, and then forwarded to market, chiefly to Glasgow, while some small quantities are sent to Edinburgh, London, &c.

Branding.

The herrings branded showed an increase of 20,285 barrels over the previous year's figures; and the superior quality of the season's cure is evident from the fact that while, as compared with 1892, only about one-half of the number of barrels were branded Matfull, the numbers to which the Full and Spent irons were applied showed excesses of 24,276 and 12,121 barrels respectively. The rejections amounted to 3113½ barrels.

Exports.

There were shipped direct from Peterhead to the Continent 186,907½ barrels; while from 17,000 to 18,000 were sent coastwise to Leith, &c., for shipment, chiefly to Hamburg, only a few parcels

going to America, &c. The most of the herrings were shipped in steamers owned chiefly abroad. Freights were moderate: to Hamburg, 1s. 2d. per barrel; Baltic ports, 1s. 4d. to 1s. 6d., and in some cases less. The despatch used in loading steamers leads frequently to rough handling of the barrels and indifferent stowage.

Boat-building.

Two steam liners, costing about £3000 each, were built at Peterhead during the year,—one being intended for fishing from Aberdeen, and the other from Peterhead. There were also turned out 4 large boats for the herring fishing, and 7 for haddocks. The herring boats cost from £380 to £420, and the haddock boats from £100 to £130 each, when fully equipped for sea.

Herring barrels.

Barrel wood was plentiful, and moderate in price; the woods chiefly used being Scotch, Norwegian, Swedish, and Russian fir, and the prices ranging from 35s. to 55s. per thousand feet. During the year about 200,000 barrels and about 3500 half-barrels were made in the district, some of which were sent to Stornoway and other fishing stations. In the course of the fishing the stocks on hand became insufficient for curers' requirements, and were supplemented by quantities brought from other districts. Nearly all the barrels were made full hooped on the bottom end, and quarter hooped with wooden hoops, with an iron hoop on the head end.

Coopers' wages.

During the herring fishing season the wages paid to coopers varied from 28s. to 32s. per week; while from 8d. to 10d. per barrel represented the market prices in the beginning of the year, and 1s. after the close of the herring fishing.

Baskets.

In this district 1619 baskets were made and branded, against 1139 in 1892.

Fraserburgh District.

Herring fishing.

The results of the summer herring fishing enabled Fraserburgh to retain its position as the principal centre of the industry. The season—an unusually early one—was opened on the 23rd of May by 12 crews, whose numbers were daily augmented by disappointed fishermen returning from the Stornoway fishing, and by crews abandoning the white fishing sooner than was anticipated, until, by the first week of July, a fleet of 805 sail had arrived, of which 760 worked from Fraserburgh, 24 from Pittulie, and 21 from Rosehearty. The boats belonging to the district numbered 260, and the remainder hailed from various parts of Scotland, a large portion coming from the Moray Firth, while contributions were made by Kirkcaldy and Kirkwall, and by the districts of Eyemouth, Wick, Stornoway, and Barra.

Although the fishing continued to be prosecuted up till 15th September, many of the crews had ceased operations by the 19th of August, and after the latter date only 16,256 crans were added to the total landed. From 1st January to 1st May 600 crans were brought ashore; May produced 793 crans; June, 17,114; July, 156,108; August, 77,919; and September, 6687, giving a total of 259,221 crans—the highest on record—against 233,744 in 1892, and an average of 322 crans per boat. The most productive weeks were those ended 8th and 22nd July, when 43,055 and

40,541 crans respectively were landed; while the heaviest day's fishing was that of 8th July, when 25,740 crans were delivered from 715 boats, admittedly the largest quantity of fresh herrings ever known to have been landed at any port in one day. The quality on that date was such as is rarely experienced at so early a period of the season. The fish were throughout of exceptionally fine quality, and as they were generally landed in good time, little deterioration took place. A feature of resemblance to the fishing of 1892 lay in the numerous individual heavy takes, ranging from 100 to 160 crans, that were secured. Prices ranged from 5s. to 26s. per cran; while the average price for the year was 12s. 8d. per cran, compared with 14s. 10d. for the preceding year. The total catches of individual crews ranged from 40 to 900 crans, and their gross earnings from £28 to £500. Many of the local fishermen were very unsuccessful, the fish not having been got upon the ground stretching between Rattray Head and Cairnbulg Point, where in former seasons the men had invariably secured their takes. As in past years, the Banffshire crews proved the most industrious and persevering body of men employed at the port of Fraserburgh, and to them is due the credit of being the leaders of the industry; while the efficiency of their boats' equipment and fishing material was unsurpassed. The Lewis fishermen displayed a considerable amount of activity, and were as successful as the Banffshire men, having frequented the same fishing grounds; while the fish landed by them were invariably of excellent quality and much in demand. The most productive fishing grounds lay from 27 to 55 miles N.N.E. of Kinnaird Head and from 12 to 15 miles off Troup Head, and the latter was mostly frequented by the crews resident in the district. Most favourable weather was experienced throughout the whole season, there being only one night on which there were no boats at sea.

Although repeated attempts were made at the herring fishing during the months of January and February, no catches of any consequence were secured, excepting from 20th January to 4th February, when light takes were landed, the herrings being of good quality and commanding good prices for kippering and freshing purposes.

Crews employed at the English herring fishing.

For about three weeks after the close of the summer herring fishing 13 local crews were engaged in the herring fishing off the Yorkshire coast, where fish were found to be very plentiful, but prices kept exceedingly low through the glutted state of the fresh markets. The earnings per crew ranged from £40 to £100. On the conclusion of the fishing on that coast, six of the crews went to Yarmouth where a similar state of matters was experienced, and where the average earnings per boat was £80, while the highest reached about £100.

Herrings cured.

Of the herrings landed 371,505 barrels were cured against 357,281 in 1892; the number of crans kippered was 14,522 as compared with 8706 for the preceding year; 3854 crans represented the quantity tinned as against 2480 in 1892; while 6487 were freshed—a large increase on the previous season.

Herring branded.

The number of barrels of herrings crown branded was 136,754½, being an increase of 3326½ barrels on the figures of 1892.

Owing to the superior quality of the fish there was a greater demand for the La Full and Full irons, and a proportionate decrease in the requests for the other brands. The prices of crown branded herrings did not fluctuate to any great extent. The lowest returns were obtained by large holders of stock who sold during the months of October and November. La Fulls realised from 22s. to 27s. per barrel; Fulls, 17s. 6d. to 24s.; Matfulls, 16s. to 22s. 6d.; Spent, 13s. to 16s.; Mixed, 13s. to 14s. A number of curers retained stocks after the close of the season in the hope of securing good prices in November, as had been the case in 1892; but instead of their expectations being realised quotations gradually fell, until, towards the end of November, Crown Fulls were changing hands at the low figure of 17s. 6d. per barrel.

Herrings exported.

The shipments of herrings direct to the Continent amounted to 294,234 barrels, and to Ireland 700, while 3153 were despatched by rail to Glasgow and thence shipped to America, and 5188 were sent by sea to Leith, principally for shipment to Hamburg; after which a balance of about 3500 barrels remained on hand, bringing the total exports up to 306,775 barrels—a number never exceeded in the history of the trade.

Haddock fishing.

In the early part of the year the haddock fishing was fairly successful, although not equal to that of former seasons at the same date; but as the season advanced the fish gradually decreased in quantity, and, for some time previous to the commencement of the herring fishing, had not extremely high prices been received, the returns would not have covered the necessary outlay. From the end of the herring fishing season to the close of the year, the fishing was a conspicuous failure, this result being due in a great measure to the prevalence of severe and protracted gales. Even, however, when an opportunity of getting to sea did occur, fish were found to be unusually scarce, and only meagre catches were landed. On the ground wrought upon by the Rosehearty fishermen the bulk of the catch was composed of small and immature haddocks, unsuitable for the southern markets, which had to be disposed of at a low figure for local consumption.

Cod fishing.

As favourable weather enabled the fishermen to proceed long distances seawards, and supplies of herrings for bait were plentiful, large takes of cod were quite general, and the total quantity landed showed a considerable increase on the figures of both of the two preceding seasons. The largest catches were brought from west of the Orkneys; but the distance was found to be too great when calm weather was experienced, and on two occasions, during the month of May, the fish landed had deteriorated to a considerable extent. The quantity cured in the districts was 2525 cwts. compared with 1579 cwts. in 1892.

Boats fitted out for the cod and ling fishing in other districts.

Fifteen boats were fitted out early in the spring for the prosecution of the cod, ling, and eel fishing in Lochinchard and the neighbourhood of the islands of Coll and Canna; but the enterprise did not produce very remunerative results, as operations were greatly hindered by the stormy weather experienced.

Boats engaged at the Shet-

During the months of April and May, 32 district crews, engaged to curers on terms similar to those of preceding years, were employed

land cod fishing.

at the Shetland cod and ling fishing, where the results obtained were far in excess of the returns for either of the previous two years; but in the latter part of the season the venture had to be abandoned on account of the prevalence of dog-fish on the grounds. The gross earnings per crew ranged from £60 to £260.

Steam trawling.

The ss. "Philorth," owned by the Fraserburgh Steam Fishing Company, Limited, and built in 1892, was made adaptable either for line fishing or beam trawling. For the first three months after being fitted out she was employed at the Faroe line fishing, but the results were so discouraging that her owners resolved to equip her for trawling, and during the whole of 1893 she fished from Aberdeen.

Fishcuring stations.

There has been no increase in the number of fishcuring stations for some years, but one—intended to cover an area of 1¼ acres—is in course of construction, and expected to be in working order for the herring fishing season of 1894.

Disposal of fish offal.

The whole of the fish offal of Fraserburgh was taken over by the Highland Oil and Manure Company, Limited, who two years ago established large works in close proximity to the town. These works, which were not completed until 1892, provide employment for nearly thirty men during the winter months of the year, and about half that number when the raw material is being received and stored; and as the refuse is not permitted by curers to lie about and decay, but is promptly despatched to these works, the sanitary condition of the fishcuring yards is considerably improved.

Boat-building.

Boat-builders were never busier than during the year under review. Twenty-two first-class boats were turned out, and 16 of the second and third-class; and all, with the exception of 7, were built to the order of local crews.

Barrel-making.

Barrel-making was exceedingly brisk during the year, as only small stocks were left over from the fishing of 1892. The total number of barrels made was 293,000, and 12,000 half barrels. The material used was generally of the finest description, consisting principally of Swedish fir, undoubtedly the best wood at present in the market for the purpose; but unusually large consignments of Finland birch were also imported, and home-grown fir and larch were greatly in demand. On account of the plentiful supply of stavewood brought into the market prices, were at a very moderate figure—Swedish fir selling at from 45s. to 60s. per thousand superficial feet; birch, 48s. to 52s.; home manufactured fir, 44s. to 51s.; and larch, 49s. to 56s. The style of hooping generally adopted as the most convenient for use at curing stations was that of wooden quarter hoops, with the bottom end full bound, and an iron hoop on the head end. French wooden hoops continued to be extensively used, as they are much superior in quality to those obtainable in this country.

Telephonic communication.

In the course of the year the villages of St Combs and Inverallochy were connected by means of the telephone, which extends along that part of the coast; and at the creeks of Pittulie, Rosehearty, and Pennan the telegraph was superseded by this mode of communication, which is wrought by the post office officials during the day, and by the coastguard at night.

A greater knowledge of the rules of navigation is now becoming necessary amongst our fishing community, seeing that they have to proceed such long distances seaward in the prosecution of their calling, as well as to make long passages to the various fishing centres around the coast. To meet this much felt want two local schoolmasters conducted classes during the winter at which this subject was taught. These classes were fairly well attended, and the services of those who carried them on were no doubt appreciated. There is every probability that in the future the classes will become a permanent institution, bound to benefit those attending them. Navigation classes.

Banff District.

The various returns for this district show a decrease in almost all the principal branches of the industry as compared with 1892. Although the summer herring fishing was a little less productive than that of the preceding season, still it was a successful one; the decrease exhibited being wholly due to the fact that the number of boats engaged was 31 less than in 1892. The average catch for the regular season over the 86 boats was 204 crans each, while the average for the 117 boats in 1892 was 162 crans, and if the early herrings landed are added, the averages would be 278 and 209 crans respectively, thus showing a decided improvement. On the other hand, the white fishing exhibited a decrease under most of the different kinds landed, although the number of boats employed was larger than in 1892. Cod and haddocks were chiefly accountable for this result, but it is more or less observable under most of the other headings. Means of capture.

The improvement in the means of capture during the last ten years is very marked, and although the number of boats is gradually falling off (especially those of the first-class), the material used in fishing is yearly increasing. The decrease in the number of first-class boats is owing to the fact that when the old ones of this class become unseaworthy, or can be disposed of to advantage, they are replaced by much larger boats, costing with all their gear when new considerably more than double the amount of those they superseded in the same condition; and instead of one or two fishermen being owners there are now generally four. The aggregate value and tonnage of boats exhibit increases of £1174 and 99 tons respectively. The value has increased in consequence of the number of new boats introduced during the last two years. In 1893 several boats were provided with steam-power for hauling the nets and other purposes, causing an addition of about £80 to the value of each boat. There were also changes in the positions of second and third-class boats, the returns of the latter falling off while those of the second-class showed an increase. The second-class boats are much larger (ranging from 23 to 27 feet keel), costing when new from £40 to £50, and carry a crew of from 1 to 3 more men than the former. The number of fishermen and boys by whom the boats were manned was 1552, of which 1206 were resident and 346 non-resident.

The netting required for the herring boats shows an increase of 396,000 square yards and of £820 respectively as compared with 1892. About one-half the herring boats used surface-rigged nets, and next year it is expected that all the boats will be equipped in this manner.

There were 106 boats in the district using great lines and 163 using small lines.

Fish landed. The total quantity and value of fish landed (exclusive of shell-fish) during the year exhibited a decrease as compared with 1892 of 16,639 cwts., and of £13,516 respectively. Of the herrings landed, 23,727 cwts. were caught during the early fishing and 61,488 cwts. during the regular summer fishing. The greater part of the former was disposed of in a fresh or lightly salted state, or made into kippers and reds, while the bulk of the latter was cured gutted for exportation. The average price obtained was about 3s. per cwt. as against nearly 4s. last year. The quality of the herrings landed was, on the whole, exceedingly good. There were occasions, however, when spents were abundant, but the proportion of full fish was unusually large.

Haddock fishing. This fishing, which is regarded as the most important one in the district, from a financial point of view, was the poorest experienced for the past eight years. It yielded only 44,373 cwts., valued at £23,648, a decrease from the preceding year of 10,278 cwts. in the quantity landed and £7398 in the value. In addition to this deficiency in the quantity, the quality was decidedly inferior to that of any previous year. The proportion of small haddocks landed was unusually large, not infrequently amounting to two-thirds of the catches, and seldom realising half the prices usually got for selected fish. This materially affected the average price for the season; and, but for the high prices obtained for selected haddocks, the industry would not have been worth prosecuting. During the last two months of the year, the few attempts made by the large boats at the usual favourite grounds, from 20 to 30 miles off, were unsuccessful, and the weather was so severe that the large boats were dispensed with, and small boats, whose operations were confined to the immediate neighbourhood of the shore, were resorted to. The price of selected haddocks varied from 8s. to 24s. per cwt., and of small from 2s. to 8s., the average price for the year being about 10s. 8d. per cwt.

Cod and ling. The quantity and value of cod landed fell off from the preceding year to the extent of 4781 cwts. and £1613 respectively; while there is also a slight decrease in the returns of ling. The dearth of these fish on the usual grounds off the coast of the district for the last two years has been remarkable; and, but for occasional shots taken off the Orkney Islands, the result of the season's operations would have been very much poorer. Codlings, however, were again plentiful, and during the months of October and November they constituted a large portion of the daily catches of the haddock boats. The average price of cod was 6s. 2d., and of ling 7s. 4d. per cwt.

The other round fish, with the exception of conger eel, and all the different varieties of flat fish, showed a decrease from 1892.

Skate, however, went up to the extent of 323 cwts. and £61 respectively.

Shell-fish. The shell-fish taken consisted of crabs, lobsters, whelks, and limpets. These all exhibited a slight improvement. Crabs were unusually plentiful in the month of August, but there being no market for them, the fishing was suspended during the most of that month. The average price of crabs was about 12s. 6d. per hundred, lobsters 1s. each, and the other shell-fish 2s. 6d. per cwt.

Average earnings of fishermen. It is very difficult to arrive at an approximate estimate of the earnings of fishermen. The season was an exceptionally poor one, owing to the Stornoway, Shetland, and Yarmouth herring fishings in most instances having yielded little more than would cover expenses; while the poor prices realised at home, together with the unsuccessful haddock fishing, affected the gross earnings considerably. The average earnings did not exceed £110 per man.

Fish sold for use in a fresh state. Like most of the other returns, that relating to fresh fish has also fallen off, the decrease in quantity being 15,685 cwts. and in value £10,241. Herrings sold for use fresh, however, show an increase of 3580 cwts. and £360 respectively. Cod, on the other hand, have gone down to the extent of 7079 cwts. in the quantity and £2370 in the value, chiefly owing to the fish being landed in bad condition, and, consequently, having to be cured by the fishermen themselves. It is estimated that 8100 barrels of haddocks were cured, about 2¼ cwts. of fresh fish yielding a barrel of smoked, thus leaving 26,148 cwts. to be disposed of fresh. The other kinds of fish used fresh, with the exception of skate, all exhibited decreases.

Fish cured. There were 6 fewer curers engaged in the herring-curing industry than in 1892, and 104 fewer coopers, gutters, and packers. The total quantity of herrings cured exhibited a slight decrease as compared with 1892. Kippering was carried to a greater or less extent throughout the season, an increase being shown under this head of 687 barrels. There was also an increase of 129 barrels in the number cured as reds.

Cod, ling, and hake. In this branch there was a decrease in the number of fish cured dried to the extent of 6250, equal to 250 cwts.

Herrings branded. There was a slight decrease in the total number of barrels of cured herrings branded, which is accounted for by some of the curers not availing themselves of the crown mixed brand to the same extent as in former years, and to the fact that a large proportion of the spent fish landed was not up to the standard of size required for the crown spent brand. Not more than three small cargoes of branded herrings were disposed of in the district, the earlier realising 20s. 6d. per barrel for Crown Fulls, and 16s. 6d. per barrel for Crown Matfulls, and the later ones 21s. 6d. for the former, and 17s. 6d. per barrel for the latter.

Herrings exported. There is a slight decrease to report on the quantity of herrings exported as compared with 1892.

Weather. During the whole of the herring fishing season the weather was remarkably good; and, but for occasional calms and foggy weather, there was no occasion for any boats remaining ashore. During the last two months of the year, however, stormy weather proved a great hindrance to the white fishing. The full force of the November gale was experienced in this district; but, fortunately,

all the boats at sea succeeded in getting safely to land before it broke out.

Complaints of damage. Since the Moray Firth was closed against trawling, the complaints of injury done to boats and gear have become much fewer than in former years. Only one case was reported during the present year, and this was of damage to the nets of one fishing boat by another. After investigation, the case was settled to the satisfaction of both parties.

Boat-building. A successful year has been experienced in the boat-building trade. A full staff of workmen was employed, and not infrequently some of the firms had to work overtime. Fifteen first-class and 10 second-class boats were built within the boundaries of the district. The former were from 50 to 56 feet of keel, the average cost of which was about £380; while the latter ranged from 18 to 25 feet of keel, and cost from £40 to £50 each.

Barrel-making. The average price of Scotch fir-wood for making barrels was 57s. per thousand superficial feet, and Swedish, 55s. per thousand. French wooden hoops cost 32s. per thousand, and English 30s., while iron hoops cost 8s. per cwt. of 54 hoops.

Buckie District.

Winter herring fishing. The winter herring fishing was commenced on the 5th of January by 160 first-class boats, and terminated about the middle of March. It was as usual prosecuted conjointly with the cod and ling fishing, and yielded 1113 crans more than in 1892. Most of the herrings landed were brought from Scrabster and Orkney; and the prices obtained ranged from 11s. to 60s. per cran, the average price being 21s. 11d.

Summer herring fishing. The great summer herring fishing extended from 1st July to 26th August. It was prosecuted by 104 first-class boats, being 65 fewer than in the previous year,—11 of which fished from Cullen, 21 from Portknockie, 12 from Findochty, and 60 from Buckie. The average catch per boat showed an increase of 29 crans over that of 1892; while there was a falling off of 3s. 0½d. in the average price per cran.

The total quantity and value of herrings landed during the whole year were less than those of 1892 by 4286 crans and £5055 respectively; while there was a reduction in the average price per cran as compared with 1892 of 2s. 3½d., and with 1891, of 8s. 7¾d.

Fishing grounds. The fishing grounds extended from off Helmsdale to Portsoy, and from 15 to 25 miles north-east of Buckie. Some good shots were also obtained from 2 to 3 miles offshore, between Portgordon and Portknockie.

Quality of herrings. The quality of the herrings during the summer was superior to that of the preceding year.

Herrings branded. The total number of barrels of herrings branded showed an increase of 3317 over 1892.

Cod and ling &c., fishery. The cod, ling, &c., fishing was prosecuted from 1st January to the 1st week of May. The best takes were got in April. Octopus was used as bait during the first fortnight of January as herrings were scarce. The number and value of cod and ling

landed showed decreases of 66,213 and £4161 respectively as compared with 1892.

In the year under review, the quantity and value of haddocks landed showed an advance, as compared with the preceding year's figures, of 1230 cwts. and £1699 respectively. Haddock fishery.

After September, when the weather permitted, fair takes were obtained on the fishing grounds which had once been so productive, but where for some years past few fish had been got, this circumstance being attributed to the exclusion of trawlers from the Moray Firth. Small haddocks, the capture of which in large quantities was a feature of the year, were chiefly found on soft or sandy ground.

The total value of the fish landed, of which the chief kinds were herrings, haddocks, cod, ling, halibut, and skate showed a decrease from that of 1892 of £8545. Value of fish landed

The average earnings of the fishermen for the year was estimated at about £175. Fishermen's average earnings.

The chief wood used for staves in 1893 was Swedish spruce, which cost from 48s. to 52s. per thousand feet. It has been found to keep the pickle and stand the heat of the sun better than the wood formerly used. Staves and hoops.

French hoops are considered the best, but they are somewhat higher in price than English. The Southampton hoops are good, and are largely used. They cost 37s. 6d. per thousand landed at Buckie.

Iron hoops are used for the head ends of barrels only. They are usually sold at £8 per ton, but there has recently been a considerable rise in their price owing to the strikes of the coal-miners.

As compared with the year 1892, the boats belonging to the district show an increase of 21 of the first, and 13 of the second-class, but a decrease of 2 third-class boats; while there was an increase in tonnage and value of 1413½ tons and £8734 respectively. Twenty first, 3 second, and 6 third-class boats were broken up, or sold and sent out of the district. Twenty-one boats were built in the district during 1893. Fishing boats.

Thirty-one lives were lost, being the greatest mortality recorded for years. Of this number, 18 were lost in returning from the English fishing during the gale of the 19th of November, while 9 men forming the crew of a Portessie boat were drowned in the gale of the 14th of February. Lives lost.

Besides 7 boats which were totally wrecked, and a similar number which sustained more or less damage, there was also a considerable loss of nets and other gear, the value of which is estimated at £5077. Loss and damage of boats.

Findhorn District.

The fisheries in this district were prosecuted with but partial success, the returns showing a decrease in all the different kinds of fish usually landed, except sprat, mackerel, and torsk.

The summer herring fishing commenced on the 11th July and continued until the 19th August. The number of boats employed Herring fishing.

was 80, being a decrease of 21 as compared with 1892. The average catch per boat was 123 crans, and the total catch 9846 crans, being 7137 crans less than in 1892. The fishing was very irregular throughout, and many of the boats did not land 50 crans for the season, while the most successful boat had 230 crans. Very few fish were caught on the inshore grounds, the bulk of the catch being taken from 10 to 15 miles off. The herrings were of fair quality and sold at from 8s. 6d. to 14s. per cran, the average price being 11s. The weather, although generally fine, was not favourable for fishing operations, calms being very prevalent, and often preventing boats from getting to the regular fishing ground. No boats were engaged to curers this season, the fish being sold daily by public auction or private bargain.

Owing to the harbours at Lossiemouth being closed for deepening operations, the usual summer herring fishing season there was suspended.

The winter herring fishing was attended with poor results. The total catch was 923 crans, 255 of which were made into bloaters, the remainder being sent to market fresh or used for bait. The general price was 20s. per cran. The only herrings sold for manure during the year was one shot of 50 crans, which was sold at 1s. per cran.

Sprat fishing. The sprat fishing, which has been a failure for the last five years, was very successful in 1893. It commenced in September (about a month earlier than usual) and continued until the close of the year. From 40 to 45 boats were employed, and a number of buyers from all parts of the country were collected at Inverness. The bulk of the catch was sent to the English market, but as sprats were plentiful at other ports, the markets were often glutted and the demand at Inverness slack. The fishermen, therefore, arranged amongst themselves to go to sea only three times a week and to endeavour to take no more than 15 crans at one shot. Prices ranged from 2s. to 10s. per cran. The fish were of fair quality and were all caught in the Beauly Firth. The total catch amounted to 45,950 cwts., valued at £3377.

Cod fishing. The cod fishing also yielded poor returns throughout the year, these fish being very scarce in the firth during the great-line fishing, and the takes seldom exceeding 100 fish per boat. A large number of cod are usually caught by the haddock boats in November and December; but this season scarcely any cod were taken on the haddock lines. The principal fishing ground was off the Caithness coast, the boats from this district often landing their catches at Wick. The fish were generally of good quality and sold at from 1s. to 2s. 6d. each. The bulk of the catch was sent to market in a fresh state. The number of cod cured in pickle has been decreasing for the last 12 years, and the quantity cured in 1893 was the smallest on record.

Ling fishing. The results of the ling fishing were also far below the average of former years, although the fish were generally of a large size and of excellent quality, and sold at from 1s. 2d. to 1s. 4d. each. The larger portion of those landed in this district were caught in the neighbourhood of the Orkney and Shetland Islands.

Haddock fishing. The haddock fishing season was the poorest since 1885, the total

quantity landed being 24,261 cwts. valued at £13,359, against 28,649 cwts. and £15,810 in 1892. The decrease was caused chiefly by Lossiemouth harbours being closed for six months—that station alone showing a decrease of 3797 cwts. as compared with 1892. The months which yielded the best results were February and March, fully one-fourth of the total catch being landed during that period. The fishing grounds embraced the whole of the firth, the small boats fishing from 1 to 5 miles off, and the large boats from 15 to 25 and occasionally 50 miles off. The haddocks caught on the more distant grounds were generally of a large size, while those caught on the inshore grounds were mostly small, and the fishermen often found it difficult to dispose of them. Several crews sent their takes to Glasgow market, where they occasionally failed to realise sufficient to cover the expense of carriage. The prices paid to the fishermen were from 12s. to 16s. per cwt. for large fish and 5s. to 6s. for small. A large portion of the catch was composed of fish which were too small for smoking purposes, and were consequently sent to market in a fresh state.

Whiting showed a decrease from 1892 of 2823 cwts. and £1359. Most of the catch was landed by the haddock fishing boats, and sent to the local markets in a fresh state. Whiting.

Very few halibut were caught in the firth during the year, the bulk of the catch being taken off the Shetland Islands in March and April. Halibut.

The flounder fishing was prosecuted chiefly by the Campbeltown fishermen and by a few crews at Nairn and Burghead. The quantity landed showed a decrease of 1139 cwts. and £706 as compared with the preceding year. There was a slight increase in the Burghead and Nairn returns; but a large decrease in the takes of the Campbeltown and Inverness boats. A great portion of the catch was sent to the English markets. Flounder.

Skate were caught chiefly by the great-line boats. They are not plentiful in the firth, and those caught are generally of a small size. The most of those landed in this district were taken from off the Shetland Islands. Skate.

The total quantity of fish landed during the year showed an increase of 10,618¾ cwts., but the value decreased to the extent of £6249, as compared with 1892.

Mussels showed a decrease of 2237 cwts., and there was also a decrease in lobsters and crabs. The total value of shell-fish fell off from the preceding year to the extent of £253. Shell-fish.

Fifteen men and two boats belonging to this district were lost at the English herring fishing. Lives lost.

Thirty-two boats belonging to the district prosecuted the herring fishing on the Irish coast in May and June, and 50 boats were employed at the English herring fishing.

During the year 21 large Zulu boats of from 50 to 53 feet keel were built in the district,—20 being carvels and 1 clinker. They were fitted out with all the latest improvements, and cost from £350 to £400, their total value being £8350. Boat-building.

The works in connection with the improvements of the Lossiemouth harbours have been going on for the last two years, and Harbours.

they are not yet nearly completed. One harbour has been deepened 6 feet, and the other is to be deepened to the same extent. They are at present removing the cofferdam from the mouth of the outer harbour, and when that is finished the boats are expected to get out and in at any state of the tide. The improvements will cost about £20,000.

The extension of the east breakwater at Nairn was completed some time ago, but the works received some damage during the gale of the 17th and 18th November.

Cromarty District.

General remarks. Although the weather was frequently stormy and unsettled, the different fisheries were prosecuted with fair success.

Herring fishing. The summer herring fishing lasted for about four weeks only, viz., from 18th July to 12th August. Herring curing was carried on at Balintore practically for the first time; and although only one curer made the venture, his example will most probably be followed by others. It is, however, felt that the locality will be unable to reap the full advantage of the harbour accommodation provided until the village is connected with the telegraphic system of the country.

Of the total catch of 5332 crans of herrings, Portmahomack yielded an average of 101 crans for 31 boats; while the boats fishing from Balintore—numbering 18—secured, on an average, 108 crans. The largest catch for one boat for the season was 142 crans; and the most successful fishing ground was about 6 miles S.S.E. of Tarbat Ness. The fish were of good quality, yielding about equal parts of fulls and matie fulls, with very few spents.

When brought into contrast with the returns of 1892, the winter herring fishing does not show a good record, there being a decrease of about 50 per cent. both in the quantity of herrings landed and in their value.

Means of capture. During the year 298 drift-net and line sailing boats were employed in the various fishings.

Fish landed. Compared with the returns for 1892, the herrings landed show a decrease in quantity of 2546 cwts., and £1599 in value,—the great falling off in value being due to the engagement of crews at 12s. per cran as contrasted with 17s. in 1892.

Sprat fishing. For the first time in a number of years sprats were landed in Cromarty district, the quantity being returned at 450 cwts.

Cod fishing. There were no cod cured in the district, all the catch being disposed of fresh.

Haddock fishing. Fishing for haddocks was successfully prosecuted all over the district, and the yield was in advance of the preceding year's returns by 2219 cwts. in quantity and £650 in value, although the average price per cwt. showed a reduction of 1s. 2d.

Barrel making. White herring barrels, mostly composed of firwood, were manufactured at Portmahomack and Balintore, the staves being procured at Tain and Invergordon.

Boat-building. Five boats were built at Balintore, and seven at Invergordon, all being of the first class.

Helmsdale District.

Winter herring and cod and ling fishing.

The winter fishing may be said to have begun on the 10th of January, and during that month 327 crans of herrings and 1158 cod were landed at Helmsdale; while the returns for the first four months of the year gave an increase of 280 crans over the quantity of herrings landed during the corresponding period of 1892, but a decrease of more than 50 per cent. in the cod and ling brought ashore. Cod were very scarce, especially during January and February, when the catch on a whole fleet of lines very rarely exceeded from 20 to 30 fish. The takes in March and April showed an improvement, but a sufficiency of herrings for bait could seldom be obtained, and boats had in consequence frequently to return without shooting their lines. There were 9 boats fishing from Helmsdale against 7 in the preceding year; and of the boats employed 5 were engaged to deliver their catches at the rate of 1s. per cod, with a bounty of from £8 to £10 per crew; while the others (as well as some crews from other districts) sold their fish at from 1s. to 2s. 4d. per cod or ling.

Summer herring fishing.

Although fishing for herrings was carried on in a more or less desultory way during June, and, indeed, at the close of the week ended 15th July it was being prosecuted by 114 boats, the regular summer herring fishing season did not commence until the week ended 22nd July, when the fish were delivered at the prices agreed on, of from 12s. to 14s. 6d. per cran, with perquisites of the value of £5; the average price—about 13s. 6d.—being 3s. 6d. below that of the previous year.

On the 25th of July the catches landed by the Helmsdale boats averaged 18 crans, and, as the result of telegrams from the district officer communicating this information to the fishery officers at Buckie, Lybster, and Wick, a large fleet of boats assembled off Helmsdale, and shortly after 6 P.M. began shooting their nets; but the week's fishing resulted in only 4173 crans being landed at Helmsdale and 352 crans at Dunbeath, the only heavy shots being secured by boats working on the outskirts of the fleet, and beyond the area on which the average catch referred to had been obtained. During certain nights in the closing week of the fishing, viz., that ended 5th August, individual shots were obtained on the inshore grounds (from 3 to 5 miles off Helmsdale) reaching as high as 100 and 125 crans, while an average of 30 crans was obtained on the night of the 1st August; but the arrangements of curers for the reception and treatment of the herrings were so disorganised by such a heavy fishing, that scarcely half of the fleet was allowed to go out during the latter part of the week, while some of those that proceeded to the grounds conveyed their catches to other places. Thus the results of the week amounted to only 6980 crans landed at Helmsdale and 792 at Dunbeath. The most successful crew obtained 320 crans during the season, while 60 crans represented the lowest return. Of the 125 boats employed, 102 belonged to the district, and the majority of the stranger boats hailed chiefly from the district of Cromarty. The 104 boats which fished from Helmsdale landed an average of 145 crans,

which shows an increase of 15 crans over the average secured by the 114 boats working for Helmsdale in 1892. The average quantity of herrings brought ashore by the 21 boats fishing from Dunbeath was 134 crans, or more than double the average of the preceding year. The average price obtained per cran was 13s. 6d., as against 17s. in 1892.

The loss of fishing material during the summer herring fishing amounted to £391, and was due chiefly to nets sinking through weight of fish.

Herrings cured on shore.

In the total quantity of herrings cured on shore, there was an increase over the previous year's figures of 3249 barrels, and of 34 crans converted into bloaters.

Herrings branded. Herrings exported.

Of herrings branded, the returns showed an excess of 2520½ barrels over those of 1892; while the quantity exported, when contrasted with the previous year's figures, exhibited an increase of 2139 barrels. The value of the herrings cured for export was estimated to amount to £12,091, exclusive of the cost of cure, as against the preceding year's assessed value of £13,700.

Herring barrels.

Of the herring barrels made in the district, over 80 per cent. were constructed of fir, grown mostly in Ross-shire; while other kinds of wood, chiefly larch, entered into the composition of the remainder. As regards hooping, four-fifths of the barrels had an iron hoop on the head end, the remainder being hooped entirely with wood.

Haddock fishing.

The haddock fishing, which attracts the largest number of boats during the last three months of the year, is prosecuted solely by crafts of from 18 to 25 feet of keel, which very rarely go beyond 6 miles from land,—the principal fishing ground being from 3 to 5 miles off. During September and part of October three-fourths of the catch was composed of small haddocks, but after that time they gradually disappeared. Eighty per cent. of the fish are split and put in pickle for about an hour, then washed and allowed to drip, when, as soon as they are sufficiently dry, they are packed in barrels and sent to Glasgow. The catch in 1893 shows an increase over the figures of the preceding year of 1923 cwts.

Cod landed.

In the returns of cod landed, there is a decrease as compared with 1892 of 3008 cwts.

Mussels landed.

There is also a falling off in the quantity of mussels taken, the total for the year being 1401 cwts. less than in 1892. The only place in the district where these molluscs are obtained in any quantity is at Little Ferry, near Golspie.

Lybster District.

Summer herring fishing.

The district summer herring fishing of 1893 was remarkable from the fact that it commenced fully a month earlier than in any previous year. On the 6th of June 8 crews made a trial for herrings, and were successful beyond their expectations. Takes of from 8 to 15 crans were got nightly, which were disposed of at Lybster and at Wick, the quality of the herrings at such an early period being considered good, and realising from 9s. 6d. to 14s. per cran. These crews were joined shortly afterwards by others

from the west coast, and they continued to fish until the 10th July, when preparations for the regular herring fishing were begun. The total quantity taken between the two dates, exclusive of those landed at Wick, was 270 crans, while during the previous year no herrings were landed before the 18th July. The boats engaged by curers began the summer fishing on the 18th of July, and it was continued until the 6th of September. The number of boats employed was 61, or 12 less than in 1892, and of these 44 were engaged to deliver their Herrings to curers at the rate of 13s. per cran for a complement of 150 crans, the remainder selling their catches daily at market prices. The prices received by unengaged boats varied from 6s. to 13s. per cran, and on one day their catches realised only 3s. 6d. per cran. The average price paid was 9s. 6d. per cran compared with 15s. 6d. per cran in 1892; while the average price for the 61 boats employed was 11s. per cran as against 14s. in 1892.

The fishing grounds ranged from 2 to 12 miles off, while a few shots were taken off Dunbeath and Helmsdale; but the bulk of the catch was got on the grounds extending from Clythness to Forse. During the first week of July a number of stranger boats landed their herrings at Lybster, owing to the winds being light and thus preventing them from proceeding to Wick, the estimated quantity landed by them being 750 crans.

On different occasions during the season telegrams were received from the officers at Wick and Helmsdale intimating successful fishings proceeding on the grounds adjacent to their districts, which were at once intimated to the local fishermen. On the 4th of August, the Helmsdale officer wired that a heavy fishing was being got that day on the grounds off his district, of which the fishermen were immediately informed. They all proceeded in that direction; but, unfortunately, the wind fell off, and only a few boats reached their destination, and next day were rewarded with good shots, one boat delivering 46 crans. This system of telegraphing the results of the fishing at the adjoining stations is appreciated very much by the fishermen, as they are always anxious to hear as to the progress of the fishing at other places on the coast.

The most successful fishing was got in the week ended 19th August, when an average of 42 crans for the 61 boats was landed; but, unfortunately, the herrings taken were of very poor quality, nine-tenths of the catch being spent fish. The highest individual take landed was 90 crans, and the highest gross catch for one boat was 182 crans, but a large number only got from 50 to 80.

The total number of crans landed gave an average of 113¼ crans per boat as against 63⅔ crans in 1892.

The herrings landed during the month of July, and up to the 12th of August, were of good quality, about one-third being full fish, and the remainder good maties. After that date, the bulk of the catch was composed mostly of spent and small empty herrings. Curing for the continental markets was begun on the 16th of June, and it became general on the 26th, the earliest date on record for the district. Curers began to select for the official brand on the 11th July, and the first parcel was presented for the

brand on the 26th; while in the previous year it was the 8th of August before branding commenced.

Fish cured. In comparison with 1892, the returns of herrings cured showed an increase of 1623 barrels, and of 377 barrels kippered. Of cod, there were only 81 barrels cured as against 567 barrels in the preceding year.

The kippering industry is carried on here principally during the prosecution of the winter herring fishing, 451 of the barrels cured in that manner being done during that period.

Herrings exported. The total number of barrels exported exhibited an increase of 2360½ barrels over 1892.

Branding. The number of barrels branded was 984 in excess of 1892. Since the introduction of the new regulations in 1890, the number of barrels branded has steadily increased, as the following figures will show:—1890, 1000 barrels; 1891, 2704½; 1892, 4806; and in 1893, 5790, the highest number branded since 1886.

About one-fourth of the men engaged in the herring fishing were hired from other districts.

Fish landed. The total quantity and value of fish landed (exclusive of shell-fish) showed increases over 1892 of 7807 cwts., and £94 respectively. The rates per cwt. received for fish caught by net and line were 3s. 3½d. and 6s. respectively, while the total quantity landed by each mode of fishing were 26,847 and 5065 cwts. as against 18,423 and 5682 in 1892, giving an average catch for each boat engaged in the net and line fishing of 214 cwts.

The decrease in the value of herrings is accounted for by the poor quality of the fish landed during the latter part of August.

Next in importance was the haddock, of which 1298 cwts., valued at £434, were taken, as compared with 713 cwts. and £256 in 1892. During the months of October and November a good many small haddocks from 8 to 10 inches in length were got, the proportion of these being about 1 cwt. in 5. Most of the fishermen were engaged to deliver their fish by a Wick curer at 6s. 3d. per cwt. for October, and 7s. 3d. per cwt. for November, the average price per cwt. being 6s. 7½d. About 40 cwts. were cured as 'Findon haddocks,' and consumed in the district.

The quantity of cod and ling taken during the year showed the large decrease of 959 cwts., while the value fell off to the extent of £283, the average price per cwt. being 7s. The largest proportion of the cod landed, which were of a small size, was caught by hand-lines, and were not suitable for pickling purposes, being mostly disposed of fresh in the localities where caught.

The fishing grounds of the district extend from 1 to 12 miles off shore; the favourite haunts of the herring lying from 3 to 12 miles off, between Clyth Head and Forse Head. Haddocks were got principally from 1 to 3 miles from land, while cod and ling were taken during the winter months at from 3 to 6 miles off, on what is locally known as the edge of the sand; but during the early summer months they were got on Smith's Bank, which lies at a distance of 13 miles in a south-easterly direction.

The average earnings of the 90 boats engaged at the herring fishing are estimated at £90.

A number of the fishermen belonging to the district are crofters,

and they are employed a part of the year in working their crofts, and only go out occasionally during winter and spring to fish with hand-lines, the fish caught being for their own use.

Weather. The weather during the year was favourable for fishing purposes, as, with the exception of three nights during the summer herring fishing, the boats were always able to go to sea. The number of times the boats were at sea between the 3rd of January and the 18th March during the winter herring fishing was 36, and the number of times between the 6th of June and the 9th September was 46. During the period between September and December, the fishermen prosecuted the haddock fishing.

The number of first-class boats belonging to the district are gradually being reduced, and no new ones are taking their place. Fishermen are also getting short of fishing material, owing to the low prices received for herrings, and their condition upon the whole is not so prosperous as it was some years ago. Lybster is now the only station in the district where curing is carried on.

Latheronwheel harbour is in a fair state of repair at present, but it is feared that since curing is not now carried on there, it will soon become useless. Lybster harbour is kept in good condition by the proprietor, the Duke of Portland, but the small harbour at Clyth is deteriorating rapidly for the want of repairs.

Wick District.

Herring fishery. The summer herring fishery began at Scrabster on the 16th May, on which day 100 boats landed the large catch of 2700 crans. A close time having been observed up to the 15th May, curers were not ready with salt and barrels to cure this large catch, and in consequence some of the herrings were sold for manure, and a good many crans were thrown into the sea as not being fit for curing purposes. From 80 to 150 boats were employed at the Scrabster fishing, which was carried on till about the end of June. The total catch of herrings amounted to 30,330 crans, or an increase of 17,576 crans as compared with the catch of 1892. Prices varied from 5s. to 36s. per cran, the average price being about 24s. 6d. per cran, giving a total value of £36,902 for the summer herring fishing. The herrings were of very good quality throughout the season, and 15,336 barrels were cured for exportation, 196 crans were kippered, and 20,987 crans were sent to market in a sprinkled state. Scrabster is yearly becoming more important as a fishing station. During the principal part of the season 59 curers and buyers were engaged in the trade. The great drawback to the development of the industry at Scrabster is the want of curing accommodation, but it is expected that this want will be largely met when the new harbour works, now in progress, are completed.

A few boats commenced the herring fishing at Wick on 3rd May; but, owing to an arrangement among the local fishermen, a number did not begin fishing till the 11th July, the date on which the regular fishing commenced. As the season advanced, 314

boats, or 40 less than in 1892, became engaged in the fishing till its close on 31st August. The catch of herrings at Wick was 52,897 crans, which gave an average of 168⅓ crans per boat; which, added to the catch at Scrabster, gave a total of 83,227 crans for the season as compared with 42,345 crans in 1892.

There were very few boats engaged to curers in 1893, the bulk of the catch being sold by auction at prices ranging from 4s. 6d. to 36s. per cran, the average price being about 11s. 6d. per cran.

The fish were got chiefly on the inshore fishing ground, lying from 2 to 12 miles off, but occasionally a number of boats fished at a distance of from 15 to 50 miles from land, and on several occasions brought ashore good takes. Calm weather, however, often prevented them from getting ashore in time, and in consequence large takes of herring of good quality became useless, and were either thrown into the sea or sold for manure.

The herrings were generally of good quality during the season, the proportion of full fish being rather more than a third of the catch. The proportion of matie fulls was under that of some previous seasons, but spent and mixed formed a large portion of the takes.

A few boats caught from 300 to 500 crans during the season, but the bulk of the fleet only obtained from 90 to 200 crans; while the catch of a good many did not exceed 50 crans.

The weather was favourable for fishing throughout the season, and only on two nights were the boats prevented from going to sea by bad weather.

It is to be regretted that the return of herring boats shows a gradual falling off. Many of the boats are becoming worn out and not fit for sea, and the owners are unable to replace them by purchasing new boats, most of those which have been sold being purchased by fishermen in Aberdeenshire, Banffshire, and Morayshire.

The herring curing industry was far from yielding profitable results to curers, prices never having reached so low a point previously. For full crown brands, prices varied from 21s. to 22s. per barrel; crown branded maties from 16s. to 20s. per barrel; spent, 13s. to 14s. per barrel; and mixed, 13s. to 13s. 6d. per barrel. Towards the close of the season holders of stocks could not dispose of them, and they were ultimately obliged to ship them to agents on the Continent.

Branding. The number of barrels of herrings branded showed an increase of 17,281 barrels over the preceding year. The brand was refused in the case of 1078 barrels, owing chiefly to the number of undersized herrings found among the maties. Good matie fulls were rather scarce this season, and in consequence fewer of them were branded in proportion to the catch than for some seasons past.

Exportation. In addition to the herrings exported direct from the district, there were 13,500 barrels shipped coastwise to Aberdeen, Leith, and Glasgow, of which about 5000 barrels were intended for the United States of America, the remainder being for Hamburg, Stettin, &c. The trade with the United States continues to increase yearly, but it has been rather overdone this season, and in

consequence some of the shippers are likely to suffer losses on their consignments.

A large proportion of the barrels made in the district was sent to Shetland, Orkney, Stornoway, and Barra, and latterly a number was sent to Ireland for mackerel curing purposes, and to Cornwall for the curing of pilchards. Barrel-making.

Nothing has been done at the Wick harbour works during the last twelve months. The harbour has not been deepened to the desired extent, greatly owing to decreasing trade, which has prevented the necessary funds from being raised. Thurso harbour works have been advanced a good deal during the year, but the river has not been sufficiently deepened, and will only admit vessels and boats at high water. The promoters of the harbour improvements at Thurso were desirous of promoting a fishing station at that place; but the slow progress of the works, together with the want of capital, will not admit of their wishes being carried out in time for next season. Preparations are being made for extending and deepening Scrabster harbour, but the works are not likely to be so far advanced as to be of much value during next season. The harbours or piers to be erected at Stroma, Scarfskerry, Dwarick, Portskerra, Skerray, and Talmine have not been commenced yet, the great difficulty being the inability of the fishermen in these localities to raise the required sum to entitle them to receive the Government grant. Harbours.

Of the 704 boats belonging to the district, 317 were engaged in the herring fishing, 361 in white fishing, and 26 in crab and lobster fishing, though a few more occasionally followed the latter fishing.

The most striking feature of the fisheries was the scarcity of cod and haddocks as compared with previous years. Neither of these fish was caught in the usual quantities on the old fishing grounds; but small haddocks, from 4 to 7 inches long, were very abundant. Fishermen are hopeful that when these small haddocks increase in size, the old fishing grounds, 6 to 8 miles off, will yield their usual supply of full-sized haddocks. Fish landed.

A marked improvement is observable in herring curing yearly, especially in selection, salting, and filling of the barrels. The quantity of haddocks cured and smoked was not large, and they were treated in the same manner as those cured at Moray Firth creeks. Great care was shown in the pickling of cod, and, so far as can be observed, the cleaning, curing, and pickling of the fish is now carried out on improved methods. Cod only were pickled, all the ling, saithe, and hake being cured and sun dried. The average price of pickled cod was about 45s. per barrel of from 18 to 20 fish. Dried cod realised about 18s. per cwt.; ling, 20s. to 22s. per cwt.; and tusk and saithe from 8s. to 10s. per cwt. Curing.

The wood most generally used for barrel-making at present is Swedish spruce, as it makes a very tight barrel, well fitted for the retention of pickle, and shrinks only slightly in the heat of the sun. Norwegian birch, however, makes the strongest barrel. The average price of the latter wood was 50s. to 55s. per thousand superficial feet, and of the former from 45s. to 50s. Barrel-making.

The wooden hoops chiefly used were of English and French Hoops.

manufacture. The English hoops are the strongest, but the French are more easily manipulated, and will not bear the same strain as the former. The average price was from 2s. 6d. to 3s. 9d. per bundle of 120 hoops. Iron hoops cost about £7, 10s. per ton delivered; but, owing to the coal strike in England, they could not be produced in sufficient quantity to meet the demand.

Telegraphic tension.

The telegraph continues to be utilised largely at the outlying portions of the district. Fishermen who cannot get curers to purchase their catches of white and shell-fish at home consign them to the southern markets direct, advising their consignees of having done so, and completing the transactions by telegraph. As usual, hired fishermen and crews of fishing boats always wired to curers or fish buyers on the east coast stating their terms, and these telegrams generally resulted in engagements. As in former seasons, the state of the fishing at Stromness, Kirkwall, Lybster, and Helmsdale was wired to Wick, and the telegrams were posted up at the fish auction mart, where all could see them. When the fishing was successful at Wick, telegraphic messages intimating the fact were sent to Scrabster, Orkney, Lybster, and Helmsdale, and very often boats from these places took advantage of the information and were successful in landing good takes of herring. The district officer's action in wiring these messages to the officers at adjoining stations, as well as to his correspondents, was much appreciated. As stated in the last Report, it is very desirable in the interests of the fishing industry that telegraphic communication should be extended to Skerray and Talmine on the west coast.

Orkney District.

Summer herring fishing.

The herring fishery in Orkney commenced on the 16th May with 7 Banffshire boats landing at Stromness on that date a total of 83 crans of excellent quality. On the 20th forty boats were on the spot, and on the 27th seventy were employed. By the 3rd of June the fleet had increased to from 300 to 340 boats. Three-fourths of this number consisted of W.K., I.N.S., B.F. and P.D. boats; the remainder belonging to Orkney. The visiting boats prosecuted the fishery with energy, whereas the local boats were late in coming forward to take part in the fishing, and when they did so their success was but poor as compared with the boats from other districts.

There were also three herring curing stations at Westray, from which 21 boats prosecuted the early herring fishing. It did not, however, prove a success, although the fishing ground was the same as that upon which the fleet from Stromness fished, namely, 10 to 20 miles N.W. of the Island of Hoy.

Boats engaged to curers at this fishing numbered only 129, and the prices agreed on ranged from 12s. to 14s. per cran. Unengaged boats had their catches sold by auction, there being four fish salesmen at Stromness during the herring season there, which terminated on the 5th July.

The total yield was 20,200 crans, which were of excellent quality throughout. Prices ranged from 11s. to 34s. 6d. per cran.

The highest single take landed was 110 crans, which realised 34s. 6d. per cran. The best catch on any one day, as to quantity and quality, since the early herring fishing started in Orkney was landed on the 13th June. It amounted to 6000 crans, which sold at an average price of 11s. per cran.

There were 33 curers on the spot, including buyers from Stornoway, who had steamers chartered to carry the herrings purchased at Stromness to Stornoway, where they were re-assorted and cured for St Petersburg, and exported thither, marked in some cases prime 'Stornoway' and 'Castlebay.'

At the other stations in Orkney, viz.:—Stronsay, Holm, Burray, and Cara, South Ronaldshay, the summer herring fishing opened between the 11th and 17th July. One hundred and seven boats were employed, all being local, and all were engaged to curers at 14s. per cran for complements of 100 to 150 crans. It closed on the 28th of August with a total catch of 9800 crans, the greater part being spent fish, caught within 4 miles off Stronsay.

Upon the whole, the catch of herring in this district in 1893 exceeds that of any other year since 1885.

Cod and ling.

Of cod and ling, &c., the number landed in Orkney in 1893 was the smallest since 1884. This was partly attributable to the low prices offered here for fish cured on board vessels at Faroe. English smacks which prosecute the cod fishing having realised better prices at Faroe and elsewhere for their fish, only 15 of these vessels entered inward in Orkney in 1893; whereas in 1892, 40 visited the islands.

Banffshire and other south country boats, which prosecuted the great-line fishing off the Orkney coast, did not call so frequently for the disposal of their catches during the spring months as they did in 1892, better prices as a rule being obtained at Wick and other stations southward.

The number of boats belonging to the district that use long-lines or great-lines is 14 only, the majority of the boats using small and hand-lines.

Practically, the bulk of the fish landed in the district is taken by vessels and boats belonging to other places.

Means of capture.

The means of capture employed are the ordinary drift-nets, long-lines, small-lines and hand-lines. Herring boats are, however, becoming fewer; and, with the exception of those regularly employed in the lobster fishery, the smaller craft returned as 'third class' boats are now used only occasionally for fishing.

Fish landed.

The total quantity landed showed a considerable improvement on the figures for 1892, as will be seen on reference to Appendix B.

Fishing grounds.

The principal early herring fishing ground in 1893 was off the Island of Hoy, 10 to 20 miles N.W., and the principal summer herring fishing ground was off Stronsay, 3 to 5 miles E. The principal cod and ling and halibut fishing ground was off the Island of Westray, 10 to 40 miles north and N.W. Banff boats frequent this ground in the spring months when weather permits. Cod of good quality are obtainable in many of the Sounds and a few miles off shore, but seldom in great quantities.

Average earnings.

The average earnings of the fishermen who prosecuted the herring and cod and ling fisheries would be about £50.

Fish cured.

The number of barrels of herrings cured in the district was 29,033, and 2943 crans of herrings were roused into barrels in an ungutted state, and conveyed to Stornoway; 350 crans were kippered at Kirkwall, and 100 crans bloated.

Cod, ling, tusk and saithe cured dried, and in pickle, amounted to 16,026 cwts., and 150 barrels.

Fish used fresh.

Fish of all kinds disposed of for consumption in a fresh state amounted to 32,811 cwts., valued at £9507; including shell fish, the total value was £15,485.

Branded.

The barrels of herrings branded numbered 9132, of which 3090½ were fulls, 516½ mat full, 5281 spent, and 244 mixed.

Exported.

The export of cured herrings for the season consisted of 16,502 barrels. This number appears small compared with the total cured, but this is accounted for by the shipments coastwise from Stromness to Leith and Stornoway, and thence exported.

Value of cured fish.

The estimated value of cured herrings branded and unbranded is £37,330; and of cod, ling, torsk and saithe cured, £11,461.

Weather.

The weather during the greater part of the spring months was very unsettled and boisterous, which accounted partly for the small catch of white fish landed during that period of the season. From May to September, the weather was all that could be desired, boats being detained in harbour on two occasions only during the herring fishing season.

Telegraphic communication.

Messages were frequently exchanged with Wick respecting the catch of herring at certain periods, and indicating fishing grounds and other particulars of interest to fishermen in following up the fishing, with the result that a few Holmsound and Watersound boats proceeded to the Caithness fishing grounds on two occasions, and returned to Orkney with fair takes. The extension of the telegraph to the remote islands in the Orkney group, such as Westray, is highly beneficial, not only to those interested in the fishing industry, but to all those engaged in any trade or business.

Shetland District.

General remarks.

Although in 1893 the fishing industry of Shetland district attracted a smaller fleet of boats than had sailed from its ports during any of the preceding seven years, the total quantity and value of fish landed showed a large increase when compared with the returns for 1892, while there was a slight advance in the gross value over the average of the preceding six years. The average value of the fish brought ashore during 1893 was, however, slightly below that of the year 1892. As the native fishermen shared to a much greater extent than formerly in the benefits arising from a successful fishing, the district was left in a fairly prosperous condition.

Faroe and Iceland cod fishing.

The only branch of the industry for which greater preparation than usual was made was the cod fishing at Faroe and Iceland, for the prosecution of which three vessels were added to the fleet; and as the crews employed, especially those at Iceland, were very successful, the

season would have proved remunerative for both owners and fishermen but for the extremely low prices ruling for dried cod.

Cod and ling fishing.

The cod and ling fishing round the coast yielded fair results, although the total catch was rather under the average.

This was in a great measure due to the almost entire failure of the early fishing, which in former years has yielded from 8000 to 12,000 cwts. of cod, the early commencement of the herring fishing having induced a large number of crews to abandon the cod and ling fishing sooner than in former years by a fortnight or three weeks, a period of the season which had generally been considered the most productive.

Men and boats.

The native boats and vessels numbered 808, and all these were engaged in the various fisheries of the district during the season. In addition about 50 boats, belonging to the districts of Buckie, Banff, and Fraserburgh, were employed at the cod and ling fishing in the months of April and May, while the early herring fishing attracted upwards of 200 boats hailing from other districts.

There were also 23 Isle of Man boats engaged in the late or August herring fishing; while 9 English smacks and 13 Faroe vessels landed part of their takes of cod for Shetland curers.

Herring fishing.

Not for many years had the early herring fishing proved so successful. The weather during the months of April and May was exceptionally fine, both on sea and land. Whether this circumstance contributed in hastening the growth of the herrings, the officer would not venture to say, but there is no doubt as to the quality of the fish being as good at the end of May as those caught in former years at the end of June. About the end of May large shots of from 50 to 80 crans were caught on the west side, which were sold at 12s. per cran. The curers on the spot soon completed their preparations for curing, and operations were at once commenced at several of the west side and Yell stations. The native fishermen who were employed at the long-line fishing now turned their attention to the herring fishing. All the boats lying on the beach were launched and at work during the first week of June, when the fishing proved most successful. During the second week of June a large number of curers, fishermen, &c., had arrived from East Coast districts and shared in a second week's successful fishing, the average for the week being from 60 to 80 crans per boat. On the 14th June dog-fish appeared on the coast and put an end to further operations, the bulk of the East Coast fishermen leaving the north stations by the 16th June. The native crews continued the fishing on the west side chiefly in St Magnus Bay. Some heavy catches were obtained in that locality, which increased the total catch considerably. The late fishing was begun at Lerwick and other east-side stations about the end of July and continued till the first week of September. With the exception of the year 1889 it proved to be the poorest fishing during the past fourteen years.

Haddock fishing.

There was a very considerable decrease in the quantity of haddocks landed during the year compared with 1892. This is wholly accounted for by the failure of the fishing during the last three months of the year. From the close of the herring fishing till the end of the year the catch amounted to only 6154 cwts., while

in the corresponding period of 1892 the catch was 17,784 cwts. The weather during the three months referred to was very unsuitable for the prosecution of this fishing, and there appeared to be a scarcity of fish on the usual fishing grounds.

Fish landed.

The total quantity of all kinds of fish landed in the district during the year amounted to 411,263 cwts. valued at £81,932, and 6153 cwts. shell-fish valued at £424, or a total value of £82,356, being an increase of 137,342 cwts. (including shell-fish) and £26,065 in value compared with the year 1892. This large increase is due chiefly to the success attending the herring fishing, the returns of which are more than double those of the former year, both in quantity and value. There were also large increases in the quantities and values of ling, tusk, saithe, and halibut, while there was a decrease of 8418 cwts. and £2982 respectively in the returns of haddocks landed.

The average price of the fish landed shows little variation from that of the preceding year, that of herrings being 13s. 1d. per cran, as against 13s. 8d. in 1892; cod, ling, tusk, and saithe, 3s. 10d. per cwt. and 3s. 7d. per cwt.; halibut, 9s. 3d. and 9s. 6d. per cwt.; haddocks, 6s. 2d. and 5s. 10d. respectively. The falling off in the latter case is accounted for by the large decrease in the returns for Lerwick and Scalloway, where the highest prices have been paid invariably.

Fishing grounds.

The only new fishing ground was that in St Magnus Bay, where in the month of July a large shoal of herrings was found so close to the land that only small boats could venture to set nets. The large boats having to set their nets a little offshore were often unsuccessful, while the smaller boats with two or three nets had often as many fish as they could take. The herrings subsequently proceeded into the Voes and remained there all the month of August; they were caught on some occasions on the beach in shallow water. Several thousand crans were taken in these narrow waters, the catches being landed at Hillswick, Papa, Voe, Walls, and Scalloway. During the month of July the fish were of very good quality, but afterwards they fell off, being mostly all spent towards the end of August. Fish were found in more or less abundance on all the usual fishing grounds in the district, the most productive locality being that part of the coast opposite Scalloway and Burra Isles.

Curing.

The curing of both herrings and cod and ling was carried on in the same manner as in former years. The early part of the season was very favourable for fish drying, and all the early caught fish were dried in good order about midsummer. During the autumn months, however, the weather was wet and unsuitable for drying purposes, artificial heat having to be resorted to, in order that the fish might be ready for market at the end of the year. The process of drying by artificial heat is now in use during all the winter months, the fish brought by the smacks from Iceland being all dried in this way, as they arrive too late in the season for sun drying.

The early caught herrings were all cured for early consumption, and were usually shipped, after being a few days in cure, by direct steamers or by mail steamers *via* Leith. With the exception of three curers, all those engaged in the trade during the month of August prepared their herrings for the official brand. The few

herrings caught in August were of very good quality and fetched comparatively high prices in the continental markets. A few hundred barrels of herrings were cured in the end of April and beginning of May for the continental markets and marked 'West 'Coast Matjes.'

Only a small proportion of the haddocks caught in the district are cured as 'Findons,' the bulk of the catch being sent to East Coast districts in ice, where they are afterwards cured and smoked, and a few sold in a fresh state. A few tons of the very large haddocks were also sent *via* Leith to Hamburg packed in ice. The quantity smoked or made into 'Findons' in the district would amount to about 5500 cwts., or about 24 per cent. of the whole catch, yielding 2000 barrels.

The selling price of cured fish has been low and the demand slack throughout the year, the average price of dried cod being 14s. per cwt.; ling, 16s. per cwt.; tusk and saithe, 12s. and 9s. per cwt. respectively. A few transactions in branded herrings took place. La Fulls sold at 27s. per barrel, Fulls 24s., Mat Fulls 18s., and Spent 16s., but the bulk of the catch was shipped on consignment.

Fish offal. As in former years all the offal was collected and converted into oil and manure at the two factories situated in Bressay and Unst.

Boat-building. Boat-building was very slack during the year, only a few boats of small size intended chiefly for inshore fishing being built.

Telegraph extensions. It is hardly possible to overrate the advantages of the recent extensions of the telegraph to the fisheries of the district, especially those of the herring and haddock. There are now 27 telegraph offices in Shetland, while five years ago there were only 17. There are still a few places at which it is intended to open offices, among them being Levenwick, Burra Isle, Sandness, and Haroldswick.

Stornoway District.

Herring fishery. For the past 30 years the herring fishery in this district has yielded from 60,000 to 120,000 barrels of cured herrings per year, and it is remarkable with what regularity the catch has been maintained in that time. The past year (1893) is, however, a notable exception, for the one outstanding feature is the failure of the herring fishery. Herring fishing began, as usual, in January, and was continued until 17th March. The 91 boats fishing from Stornoway at that time comprised 48 B.F., 35 S.Y., and 8 I.N.S.

During this early season the weather was variable, and strong breezes generally prevailed. The fish were caught chiefly on the inshore grounds between Stornoway and Tiumpan Head, and being large and of good quality, good prices ruled all the season, and the fishermen especially did well, realising an average price of 20s. per cran. The total catch for the winter season was 13,053 crans, being an increase of 7799 crans on the winter catch of the preceding year. After the usual close time, extending from 15th April to 15th May, the summer herring fishing began. Then everyone looked forward to a repetition of the successes of past years, but they were greatly disappointed, for the catch was only 17,740 crans, as compared with 90,703 in the preceding season.

Such a failure had never before occurred except in the year 1876, when the catch was 19,270 crans.

Boats employed.

Stornoway is the chief centre of the herring fishery of the district, and, as already noted, there were 91 boats fishing here in the winter. During the summer there were 674 boats at Stornoway, 10 at Carloway, and 37 at Harris—in all 721.

Of these 601 belonged to other districts of Scotland, and 120 were local boats. The preparations for the fishing were as extensive as ever. The first week of the season yielded 7541 crans, and this proved the best week's catch. After the opening week herrings became scarce, the boats searched everywhere in the waters usually frequented, but not a single good haul could be got, and soon it was agreed that there was no body of fish on the ground. As a reason for this some of the fishermen asserted that the herrings had matured earlier, and were, they presumed, about a month in advance of their usual course, and that the great body had passed through our waters during the close time. Others averred that the herrings were on the ground, but did not rise. Several times whales and large flocks of birds were seen in the Minch, but these indications boded no good, and by the 8th June, the little life that remained in the industry went out, and the summer herring fishing had failed. Soon it was reported that large bodies of herrings had been found on the Scrabster and Stromness fishing grounds, and thither most of the Stornoway fleet repaired and engaged in the fishing with much success. To meet these changed circumstances the curers at Stornoway joined together in companies and chartered steamers, which were employed for weeks carrying the herrings from Scrabster and Stromness to Stornoway, where the curing operations were completed. The herrings caught in the Minch and that vicinity were small and soft; those brought from Scrabster and Stromness were large and generally full of milt and roe,—being exceedingly well developed for such an early season. They were not, however, regarded as the matje, the herring indigenous to the west coast, but were looked upon rather as a specimen of the east coast herring. Owing to the scarcity of fish, prices ruled high all the season, and that realised by the fishermen would not average less than 36s. per cran.

Fish landed.

The produce of the fisheries for the year was valued at £77,307, as compared with £110,168 in the preceding year. The decrease was chiefly due to the failure of the herring fishing, in which branch alone there was a decrease of £33,045. There was remarkably little change in the returns of the other kinds of fish, in comparison with the results of the preceding year, except a slight increase in the quantity and value of ling. The staple produce of the fisheries here, stated in the order of value, are herrings, ling, lobsters, haddocks, and cod.

Fish cured.

During the year 22,735 barrels of herrings were cured gutted, 12,748 crans kippered, 83 crans red or bloated, and 27 crans tinned. The cod, ling, and saithe fishing showed some improvement, but the sale of these when cured is becoming more difficult and unremunerative year by year. The quantity cured consisted of 36,189 cod, 297,380 ling, and 22,044 saithe. Most of these fish

were dried, and when prepared for market the yield was 16,232 cwts. of dried fish, and 893 barrels of pickled.

Fish used fresh.

The value of white fish used fresh was £26,745, as compared with £32,629 in the preceding year. This department shows comparatively less change, as the quantity of the herrings caught here and sent off in a fresh state to market is not large. It is notable, however, that the results of the haddock fishing were much under those of last year, showing a decrease of not less than £3179. Of shell-fish and other kinds, the returns show a remarkable similarity to the figures of the preceding year.

Fish exported.

As compared with 1892, the decrease in herrings exported was 16,067 barrels, and of the total export of 36,785½, St Petersburg received fully three-fourths. In this connection, however, it is very important to keep in mind that our catch and exportation of fish have little or no relation to each other, since a very large part of the fish cured in this district—herrings, cod, ling, &c.—are first carried coastwise to Leith, Glasgow, and other ports, and thence exported; and thus appear in the returns as the exports of the latter places.

Weather.

During the early spring months the weather was generally stormy, and not favourable for fishing; the summer was fine, with an inclination to frequent calms. October to December was perhaps the stormiest season ever experienced. The rainfall was almost incessant—a great drawback to the success and wellbeing of this Island—and nearly all the casualties that happened in connection with the fisheries occurred in November and December.

Loss of life and loss and damage to boats and fishing gear.

In the severe storm of November, one small Harris boat foundered in the Minch with her crew of 5 men, and in December a haddock boat with a crew of 7 men was lost in Broadbay. In all, 14 men were drowned, which is, unfortunately, a heavy loss compared with previous records. During the summer herring fishing the losses of gear were very light. The loss in boats and gear for the year is estimated at £946, being £32 less than the estimated losses of 1892.

Telegraphs and harbours.

No further extension of the telegraph has been carried out in the district for some years. Those extensions made some years ago, under grants from the Fishery Board, continue to give satisfaction, affording much-prized facilities and tending to the benefit and improvement of the fishing industry. At Stornoway two large wharves have been built mainly for the accommodation of fishing boats, embankments have been erected, and extensive dredging operations engaged in, all at a cost of about £30,000, while the Harbour Trustees are just about to commence building a fish mart at Stornoway at a cost of about £1500.

Barra District.

General remarks.

The fisheries throughout this district during 1893 were attended with rather better results than in the preceding year. The most important line fishing is that of cod and ling, which commenced early in February, and continued till the end of June. Although the season opened with an unusual scarcity of fish in

the Minch, the gross quantity landed was heavier than that of any of the three previous years. The principal fishing ground was in the Atlantic from 8 to 10 miles off Barrahead, where takes of 1000 ling were frequently got at a single haul. Nearly the whole of the catch was cured dried and imported to home markets, where it realised from £18 to £23 per ton. The value of dried fish was estimated at £5320. The eel and flounder fishings were both fairly productive, showing an increase of £478 over the yield of 1892. Haddock fishing receives little attention, as the class of fish caught are unsuitable for the fresh fish markets.

The herring fishing, which is chiefly carried on by fishcurers and fishermen from the Moray Firth, began on 2nd May and lasted only for seven weeks, the boats being engaged for a shorter period than hitherto, owing to the uncertain results of recent years. All the boats were engaged to fish to curers at from 18s. to 30s. per cran, with from £25 to £55 bounty. The bounty paid to fishermen amounted only to about £6000 as against £13,000 for the previous year. The catch greatly exceeded that of 1892; still, the season could not be pronounced a successful one, for while some curers made fair returns, others incurred loss. One notable incident of the season was the entire absence of herrings on the rich fishing banks of the Atlantic. Out of a total catch of 3784 crans, only 88 were real Castlebay herring. Only 190 boats prosecuted the fishing in the district,—of which 20 fished from Lochboisdale and 170 from Castlebay, compared with an average fleet of 500 boats in former seasons. The quality of the fish landed was on the whole good. The best takes were got near Canna. The herring fishing, which has been prosecuted in the district for fully thirty years, shows a gradual falling off. Lochmaddy, North Bay, and Vatersay, each with its large fleet of boats, are now curing stations of the past. The whole of the catch was cured gutted for the Continent; the principal markets were St Petersburg, Stettin, and Hamburg; and the prices realised ranged from 60s. to 160s. per barrel for selected fish.

The chief industry prosecuted by native fishermen is that of lobster fishing, at which fully two-thirds of the men are employed. The season was fairly successful, the catch being 19,431 lobsters, and its assessed value £935, over the returns of 1892. The quantity of cockles taken from the Barra beds was the greatest since 1886, 6049 cwts. being sent to market.

Means of capture.

Of the 329 boats belonging to the district, fully 66 per cent. are of the third class. Eighty boats are employed at the herring and cod and ling fisheries, and 249 with small lines, hand lines, and in lobster fishing; and all are sailing vessels. The creels used in the capture of lobsters number 9650.

Fish landed.

The total quantity of fish landed during the year (exclusive of shell-fish, which realised £5191) shows an increase of 14,323 cwts., but a decrease in value of £3960, as compared with the yield of 1892; and this return includes 2001 cwts., valued at £517, used for bait, statistics of which were never previously collected.

Of herrings there was an increase, contrasted with 1892, of 11,740 cwts. in the quantity brought ashore, but a decrease in

value of £5211. The average price paid was 40s. per cran. The best takes were got in close proximity to the Island of Canna; and the average catch per boat was only 22½ crans, all caught by drift-nets. The average earnings per boat for the season of seven weeks would be about £50, including bounty.

Only 190 cwts. of mackerel, of an estimated value of £21, were landed. Mackerel appeared on this coast off Barrahead on the last week of April, being a month earlier than in the preceding year, and they have undoubtedly taken possession of the once famous herring fishing ground. On 11th and 12th May, 70 crans of mackerel were brought ashore by boats fishing for herrings, and the crews reported having seen shoals of mackerel at from 30 to 40 miles N.W. of Barra. To encourage the development of a mackerel fishery in Scottish waters, an experiment was made at Castlebay by the Board in June. It is generally believed that a mackerel fishery could be established at Barra. The fish are of large size and good quality, and the number in a barrel of 220 lbs. when cured and ready for market range from 228 to 236 fish.

Next in importance to herrings rank cod and ling, of which there were 518 cwts. landed in excess of the returns for 1892, while the estimated value showed an increase of £467. The prices at which fishermen were engaged ranged from 4d. to 4½d. per cod and 8d. to 9d. per ling. The most productive fishing ground was from 8 to 10 miles off Barrahead W. by S. in 40 to 60 fathoms of water, and the bait mostly used was halibut, flounder, and eel. Ling frequent this coast in greater abundance than cod, and are chiefly sought after, being of more value and better quality than cod; commanding, when dried, the highest prices in the Glasgow market.

Of eels there was an increase over the figures of the previous year of 1000 cwts. in the quantity landed, and an excess in the assessed value of £453. For the gross yield, which included 473 cwts. used for baiting long lines, an average price of 8s. per cwt. was obtained. All down the Minch, from Harris to Barrahead, there is good eel-fishing ground, the bottom being soft and muddy, and the fish obtained are the finest white conger, measuring often from 5 to 7 feet in length, and from 24 to 30 inches in girth.

The principal kind of flat fish landed was plaice,—of which 605 cwts., valued at £193, were used for bait. The plaice caught in this district are of small size, and do not sell well in the English markets.

Only 190 cwts. of skate, valued at £21, were sent to market. Skate are found both in the Minch and on the Atlantic fishing grounds in abundance, but they are not fished much, being of so little value, and are generally thrown back into the sea when the lines are being hauled.

Practically speaking, line fishing is only carried on for six months in the year, and could not be prosecuted during the autumn and winter months on account of the coast being subject to severe and sudden storms. The average earnings per boat, with a crew of 6 men, was about £80 for the season. Earnings of fishermen.

To the total catch of shell-fish, lobsters made the largest contribution. The lobster fishing is prosecuted by crofters, who Shell-fish

devote to it the greatest attention during summer, July and August being the most productive months. The lobsters landed in 1893 show, as compared with the preceding year's returns, an increase of 19,431 in number, while the assessed value exceeded that of 1891 by £403, and that of 1892 by £935. The average earnings for boats fishing all the year round is estimated at £80.

Fish used in a fresh state.

Very few fish are sent to market fresh from this district, the high rates absorbing all profit; and the returns yielded by several consignments of ling sent during the spring were not sufficient to cover the attendant outlay. Eels are the only fish sent regularly to the English market.

Fish cured. Herrings.

The principal stations for the curing of herrings were Lochboisdale and Castlebay, at which 888 persons were employed during the year. Of the season's catch, there were 4312 more barrels cured gutted than in the preceding year.

Mackerel.

Of mackerel there were 3 barrels cured, and sent *via* Glasgow to America.

Cod, ling, and tusk.

The curing of cod and ling shows a slight increase as compared with 1892. The fish are all conveyed to Glasgow, where they find a ready market.

Herrings exported.

Of the season's cure only 2865½ barrels were exported direct to the Continent, the remainder being shipped *via* Leith.

Damage to boats and gear.

The damage to boats and loss of fishing gear is assessed at £330 less than that of the previous year.

Telegraph extension.

The benefits derived from the extension of the telegraph to Castlebay and Barra are yearly increasing, both as regards the fisheries and the prosperity of the district generally. As the herrings caught at Barra are the most valuable in the United Kingdom, and their richness necessitates their being cured for almost immediate consumption, telegraphic communication with the continental markets has proved of the greatest importance; for by its means current prices and the stocks on hand at the different ports can be ascertained, and curers are thus enabled to discover in what markets sales can be made to the best advantage.

Lochbroom District.

The most remarkable feature of the past year's fishing has been the large quantity of herrings taken in the district. These fish became plentiful in the vicinity of Lochinver about the middle of August, and from that time until the middle of November 4500 crans were caught. In the beginning of September it was found that large shoals had also gone into Lochinchard and Lochbroom, and from that time until the end of the year 12,810 crans were landed or sold to carrying vessels at Lochinchard, and 11,800 crans were similarly disposed of in Lochbroom. Herrings were also plentiful in Loch Glendhu and Loch Glencoul; in fact, the fishing had to be suspended at all these places for want of buyers. Owing to such large quantities being secured, prices were low, ranging from 3s. to 9s. per cran,—the

latter price being paid only for a few crans at the beginning of the season. The local fishermen have complained a good deal of the want of railway communication, believing that if there had been any means of getting the fish to market fresh, they would have been able to at least make a fair livelihood; and there is no doubt this belief is well founded, as there were often periods during the last two months of the year when it was useless to catch herrings, as nothing could be done with them.

On the other hand, the majority of those who cured their herrings were unable to dispose of them, and prices fell considerably, both in the home and foreign markets. Under these circumstances, the estimate of the value of cured herrings given in the appendices is based on the prices current at 31st December.

Many of the crofters have stocks on hand which will suffice to supply their wants for several years, unless they can dispose of them in the interval. When fish were plentiful and buyers scarce, tubs and boxes were used in addition to barrels for purposes of curing in the expectation that some less fortunate neighbours would require supplies; but as the fishing was uniformly good over the whole of the North-West Highlands, their hopes were not realised.

The herring fishing in May and June was almost a failure, only 502 barrels being cured by the four firms located at Loch Clash and Lochinver. A few crans were caught at the former place during the Lewis voluntary close time.

The total quantity and value of herrings landed show an increase over 1892 of 105,253 cwts., and £8572,—a most gratifying result, and the largest quantity and value recorded since statistics were first collected.

Boats.

There has been a gradual decrease in the number of boats belonging to the district during the last five years, the figures for 1889 being 638, while last year it had fallen to 543. It is estimated that 71 remained unlaunched during the year.

Fishermen.

A number of the local fishermen leave their homes in summer and engage themselves as hired hands at the east coast herring fishing. A large proportion are crofter fishermen who fish only occasionally and mostly for their own use, devoting the greater part of their time to their crofts, on which they chiefly depend for their livelihood.

Cod and ling fishing.

This fishing began in February and was scarcely up to the average of preceding years, being so very much interrupted by stormy weather during the first five weeks, that stranger crews got disheartened and left for home without setting their lines. Subsequently the weather became more favourable, and good catches were got. In the northern part of the district, where the fishing is chiefly carried on, the fishermen, when the wind is at all favourable, land their catches at Stornoway, as they are there assured of a ready sale, whereas when they carry their fish home they have to split, clean, and cure them, which is not so profitable.

Fishing grounds.

The principal fishing grounds for cod and ling were in the Minch on the various fishing banks between the Sutherlandshire coast and the Butt of Lewis, and on the bank outside Gairloch; and for herring in the various lochs.

A firm at Gairloch manufactured 400 barrels during the year, which is quite exceptional, as fishcurers usually make or buy their stock at east coast stations.

Lochcarron District.

The fisheries of the district show a marked improvement on the preceding year, both as regards the total quantity landed and value received.

Herring hery.

Herrings were chiefly accountable for this, all the other kinds of fish showing only average results.

The early herring fishing was not prosecuted with any degree of success, there being only 342 crans landed for the first six months of the year.

A general commencement was made at the regular summer and autumn fishing in the beginning of July; but, with the exception of that at Loch Dunvegan, where over 1400 crans were landed, very little was done during the month. Early in August a good fishing began at Loch Hourn, which continued till the end of November, and yielded a total catch of 24,476 crans. Towards the close of August herrings were also got at Lochs Scavaig and Slapin, but after about two weeks' duration, the fishing came to an abrupt termination, owing to the herrings almost entirely disappearing. At Loch Torridon, which has given poor results for a number of years past, a large shoal of herrings appeared in September, and a fairly regular fishing was carried on until well on in October, at the end of which month the catch amounted to over 5000 crans. During the first week of October, a plentiful supply of herrings was got at Loch Eyshort, and from that time till the end of December, a continuous fishing was carried on there. In previous years this loch was not considered of much importance; but of late, more especially during 1891 and 1893, it has been one of the most prolific lochs in the district.

Takes of 10, 20, and 30 crans were almost an every-day occurrence, both at Lochs Hourn and Eyshort, and shots of 70 and 80 crans were not uncommon.

October proved the best month of the year, nearly 21,000 crans being taken. The quality of the fish was generally very good throughout the season—ranging in size from 700 to 1200 to the cran. The average price during August and September was about 10s., October 7s., November 5s., and December 4s. 6d.,—the average being a little over 7s. per cran. The best prices were got at Stromeferry, where railway communication facilitates the despatch of the fish to the fresh markets.

Owing to the abundant supply some difficulty was experienced in getting a ready sale for all the herrings, and this had a somewhat depressing effect on the fishing.

At Loch Eyshort during the week ended 28th October, about 500 crans had to be thrown overboard, all the curing vessels being fully supplied with fish and short of curing materials.

The value of the herrings landed show an increase over 1892 of £11,111.

About 80 of the 948 boats belonging to the district remained unlaunched during the year. This is partly accounted for by some of the fishermen being engaged in work on shore, and also by some of the boats being considered too small to proceed to the more distant fishing grounds.

The largest number of boats engaged at one time was 480, manned by 1680 men and boys; about one-half of which belonged to the district, while the others hailed from various creeks on the east and west coasts.

The returns of white fish landed showed an increase over the preceding year of 134,254 cwts. in quantity and £10,566 in value. In comparing the quantity and value of fish taken during 1893 with the average of the preceding three years, there is an increase of 109,831 cwts. and £9375 respectively.

Cod and ling. The cod and ling returns show an increase of 210 cwts. in quantity, but a decrease of £239 in value. The average price obtained was 6s. 4d. per cwt., being about 1s. below the price realised in 1892. Most of these fish were caught on the west side of Skye, and a large proportion of them were split and cured dried.

Saithe. By far the greater portion of the saithe was taken at Lochcarron, and despatched per rail to market from Stromeferry. The quantity landed and the value thereof exhibited a decrease of 1159 cwts. and £99 respectively from 1892.

Other kinds. More than one-half of the catch of haddocks and skate was landed at Sleat, while all the turbot and halibut were taken at Glendale; the soles, as well as a large proportion of flounders, being landed also at Sleat.

A variety of fish is included under 'other kinds,' but gurnard contributes by far the largest proportion. These were principally taken in the early part of the year at the mouth of Lochcarron, and despatched to the fresh markets from Stromeferry.

Means of capture. All the boats in the district are manned by crofter fishermen, who fish during only a portion of the year, a great deal of their time being devoted to agriculture.

The majority of the younger men, however, leave the district about the months of April and May for the purpose of securing berths on board yachts, which they leave in October. The average earnings of the boats belonging to the district was only about £30 per crew, usually composed of 3 men.

Lobsters were taken at various creeks, but the majority were got on the west side of Skye. All the crabs were caught on the Applecross coast, and the few mussels taken were gathered at Lochs Dunvegan and Ainort, and used for baiting lines.

Fish cured. Most of the herring curing in this district is done on board vessels in the lochs. Of 91 curers engaged, only 38 were resident, while of the 642 persons employed in gutting, packing, &c., 560 resided in the district. Large quantities of herrings cured in the district lochs were landed at stations in other districts. Kippering was regularly carried on at Broadford between July and December.

Cod and ling curing is conducted almost entirely by the fishermen themselves. The total number of fish cured was 28,782,

which produced 1166 cwts., compared with 89,202 fish and 3658 cwts. in 1892, a very marked falling off.

Fish sold for use in a fresh state.

During the fishing season there were 12 steamers engaged in conveying fresh as well as cured herrings to Stromeferry, Oban, and Glasgow.

Of the total quantity of cod and ling taken, about one-third was used for consumption fresh. This branch of the fishing industry would be greatly improved by an increase in the facilities for despatching fresh fish to the southern markets. Glasgow and Billingsgate are the principal markets patronised.

Herrings exported.

The number of barrels of herrings exported was 1194 as against 580 in 1892. These were taken direct from Lochs Hourn and Eyshort to Ireland. There were no direct shipments to the Continent, although a few barrels were sent *viâ* Leith. Most of the cured herrings were despatched to Glasgow, and there disposed of for home consumption.

Weather.

Up to the beginning of September the weather was exceptionally good; but, subsequent to that date, an almost incessant gale of wind, accompanied by heavy rains, was experienced. The most destructive gale of the year was that on the 17th November, when five lives were lost, and great damage done to the fishing craft. At Lochs Slapin and Eyshort no fewer than 10 curing vessels were stranded, while other 2 were in a similar predicament at Isleornsay.

These were all more or less seriously damaged; while some of them are still lying where they struck. In addition, 9 fishing boats were totally wrecked and 6 damaged, and the fishing gear suffered considerably. A quantity of fresh and cured herrings were also washed overboard and lost.

Broadford harbour.

Great advantage was taken of the new pier at Broadford during the fishing season.

In addition to carts being almost daily employed, a steamer visited the port occasionally and brought quantities of herrings for curing purposes, 1200 crans being landed from Loch Eyshort. There were two local and four other buyers located at the quay. It is estimated that the quantity landed in the locality was increased by about three-fourths through the landing facilities now afforded.

Fort William District.

Herring fishery.

The principal stations throughout the herring fishing season were Canna, Lochs Nevis and Buie, and Loch-na-Nuagh.

In May and June a fishing was carried on with fair success by the Barra fleet in the vicinity of Canna, the herrings being cured at Castlebay and exported to the Continent. This led to an early start being made at the regular fishing, and curing operations were begun at Canna in the middle of August, but it was not till the 1st of October that any real good was done. From this time to the close of the fishing in the middle of November good takes were landed, notwithstanding that, owing to the stormy nature of the weather, the boats were occasionally only once or twice a week at sea during the period.

The week which produced the best results was that ending 7th October, with 692 crans for 18 boats; and the heaviest day's fishing gave an average of 18 crans for 35 boats.

It is pleasing to record that over 400 crans of the total catch was secured in the immediate proximity of the island, the remainder of the catch being taken from the Skye lochs. At one time 35 boats, and 200 persons, were employed at this fishing. The total catch was 3212 crans against 2130 in 1892.

In Loch Nevis the winter fishing of 1892 was continued in January by a few local crews with fair success, about 200 crans being landed. The regular summer fishing was begun at the end of July, and, although the prospects were good in the early part of the season, little was done, and at its close in December the total catch was only 917 crans as compared with 3050 in the previous season.

About 400 crans were caught in Loch-na-Nuagh, during a few weeks in October and November, by the fishermen of the neighbouring localities, and cured by them. The catch would have been much larger if there had been buyers on the ground, but the uncertainty of these loch fishings acts as a drawback, more especially when herrings are abundant elsewhere, as was the case in 1893.

The Loch Buie fishing was prosecuted for only a fortnight in the middle of November, and was discontinued mainly on account of stormy weather, but also for want of buyers, as the fresh fish markets were glutted at this time. The highest take was about 70 crans by a seine-net boat. The total catch was about 408 crans against 176 in 1892.

Of the herring fishing in the other lochs little of interest falls to be recorded, and it has only to be stated that a fair week's fishing was landed in Lochs Leven and Sunart during November, and that the catch for Loch Scriddan during the last three months of the year was 170 crans as against 594 in 1892.

The total catch for the district was 5623 crans, a decrease of 1504 from the preceding year.

Means of capture.

The number of boats employed during the year was 405, with an aggregate tonnage of 1284, being a decrease of 11 boats and 15 tons from 1892. Of these, 63 per cent. were boats under 18 feet of keel, and used for only a short period of the year. The boats represent a value of £4557, which, with £4137 for fishing gear, shows a total of £8694 embarked in the fishing industry in the district as compared with £4858, £4579, and £9437 respectively for 1892.

The area of netting used was 966,400 square yards, value £2477; of which seine-nets comprised 9600 square yards, and cod-nets, 12,800 square yards, the latter being used only by the Oban fishermen. The decrease of 305,600 square yards in the netting, representing a value of £789, was no doubt due to the light fishing, as the number of boats employed was practically the same as in the preceding year.

The total length of long lines and hand lines was 391,930 yards, value £808. The three best stations for line fishing are Tiree with about one-third of the whole length, Moidart, and Oban.

Fish landed. The total quantity of fish landed in the district during the year was 40,353 cwts., of the value of £10,187, as compared with 43,563 cwts. and 11,077 in 1892; the chief decrease being in herrings.

So far as quantity goes, the herring fishing was the principal branch of the industry, with a total of 19,679 cwts., value £2618, being about 49 per cent. of the quantity and 26 per cent. of the value. More than half the catch was landed at Canna. The quality as a rule was good; prices ranging from 5s. at Loch Buie to £3, 15s. per cran at Fort William, the average being 9s. 4d. against 9s. 8d. in 1892. Of boats belonging to the district, 227 manned by 499 men took part in this fishing during the year. The herring fishing fluctuates so much that there cannot be said to be a regular fishing ground in the district. There appears, however, to be a shoal passing northwards in April and May to the west of Tiree and Coll, and evidently the fishing at Canna in May and June was due to the passage of this shoal.

Cod and ling fishery. Next in importance is the cod and ling fishing, which shows a total of 14,876 cwts., value £4758, against 14,387 cwts. and £5242 in 1892. Of the total catch, 3864 cwts., or about 26 per cent., were landed by the 12 east coast crews, giving them an average of 322 cwts. per boat against 75 cwts. for each of the 148 home boats. But it must be noticed that 8 of the Tiree boats averaged 376 cwts., the highest having 454 cwts. against 528 for the most successful of the stranger boats. The chief centres were Tiree, Coll, Canna, Oban, and Moidart; the best fishing banks being from 10 to 16 miles to the west of the first three stations, and 7 miles south of Tiree. In connection with the bank south of Tiree, complaints were made of the spawn being destroyed by steam-trawlers, and an effort was made by the fishermen to get these waters closed. The great bulk of the catch was secured during the months of March to June inclusive. The number of local fishermen employed was 409. The average prices were:—Cod, 7s. 2d. per cwt.; ling, 6s. 3d.; and saithe, 4s. 10d. The highest prices were secured at Oban, viz., cod 16s. and ling 20s. per cwt.

Eel fishing. The total quantity of eels landed was 2672 cwts., valued at £1616, an increase on the previous season of 429 cwts. and £250 respectively, although the fishing at Canna in October and November was fully 800 cwts. below the catch for the corresponding period of 1892. Almost the entire catch was landed by the east coast crews already mentioned, and by two steam-line boats from Aberdeen and Peterhead, which landed 112 cwts. at Oban. The Coll and Canna banks were the principal fishing grounds. The bulk of the catch was landed during April, May, and June.

Haddocks and whitings. A few haddocks and whitings were obtained chiefly at Oban and Duror, the totals for both being 186 cwts., value £180, against 517 cwts. and £464 in 1892.

Flat fish. Beyond a few cwts. of halibut, the only flat fish landed in the district were flounders, with a total of 1466 cwts., valued at £650, an increase on 1892 of 656 cwts., and £303. The principal fishing grounds were on the south-west coast of Mull and at Tiree.

There is little to state regarding skate and 'other kinds of fish.' These were mostly landed at Oban, Duror, and Tiree, and

with the exception of skate, were generally consumed in the localities where caught. The figures are :—Skate, 338 cwts., value £79; and other kinds, 1074 cwts., value £253.

Although the catch was almost equally divided between net and line fishing, the line fish yielded about three-fourths of the value.

The total value of the shell fisheries was a little above that of the preceding year, being £3161 against £2990. Lobsters, which are principally fished for on the south and west coasts of Mull, and at Canna and Muck, amounted to 485 hundreds, value £1981, compared with 502 hundreds and £2056 in 1892. Fifty-two boats and 127 men were employed at this fishing. The 172 cwts. of mussels were used as bait, as were also the crabs landed. Other shell-fish—chiefly winkles—were obtained all along the coast, the best localities being Loch Scriddan, and Arisaig, Tobermory, Ardnamurchan, Eigg, and Oban.

In considering the average earnings of the fishermen, it is surprising to find the large percentage of the total value of fish landed which falls to be credited to the few visiting crews.

At Canna in the herring fishing, 35 Barra boats grossed £1350, —or an average of about £39, while about £6, 6s. was the average for the 227 boats belonging to the district. Again, in the line fishing, the gross value of fish landed by the 14 visiting crews was £2688—including £90 for herrings—an average of £192 per boat, compared with an average of £31, 17s. for the 148 local line boats. Thus, of the total value of net and line fish, the stranger crews represent 39½ per cent. and over 30 per cent. of the value of all fish landed. While the average earnings for the 405 district boats was only £24, 9s., several of the Tiree boats would average about £120—one of them making a total of about £170 between net and line fishing.

This comparison is made because the latter fishermen are solely dependent on the fishing, and to show that the low percentage of the native boats is accounted for by the fact of such a large number of the fishermen being crofters as well, and only prosecuting the fishing as occasion may suit. Of the 913 fishermen employed, it is estimated that fully one-third were very seldom at sea, and added little or nothing to the total value.

Fish sold for use in a fresh state.

The quantity of fish used fresh was about the same as in 1892, the totals being 13,840 cwts., value £5287, or, including £3161 for shell-fish, £8448, against £8206 in the preceding year. With the exception of herring, eels, and flounders, the greater part of the fish was consumed locally. A fair proportion of the herrings was used as bait, but nearly all the eels were sent to the English markets, realising from 9s. 6d. to 13s. per cwt. to the fishermen.

Fish cured. Herrings.

Of herrings cured on shore, Canna shows two-thirds of the total of 5161 barrels, the only other place of any consequence being Loch Nevis; 1901 barrels gutted were cured on board of the 11 vessels fitted out, making a total of 7062 barrels,—being 6633 barrels gutted and 429 ungutted, a decrease from 1892 of 935 barrels gutted and 52 ungutted. Of the 1901 barrels cured at sea, only 366 barrels were cured in the district. The estimated value

of the 7062 barrels was £5711. Prices ranged from 14s. to 21s. per barrel.

Cod, ling, &c.

The totals for cod, ling, tusk, and saithe cured were:—Number of fish 86,939, weight 3461 cwts., against 2661 cwts. in 1892. These figures are, however, misleading, as in the returns for 1893, the fish cured by the east coast crews are included, whereas formerly they were returned by the east coast officers. The quantity cured by local fishermen is 2056 cwts. as compared with 2661 in 1892, and taking into account those cured by the visiting crews in 1892, there is a decrease in 1893 of 504 cwts. The principal stations were Tiree with 1332 cwts., and Coll with 929 cwts. The estimated value of the 3461 cwts. was £2872, the prices being, cod £14 and £16 per ton, and ling £17 and £18, 5s. per ton. All the fish were cured dried.

Herrings exported.

The exportations from Canna consisted of 370 barrels cured ungutted to Ireland and 1077 barrels gutted to the Continent, as compared with 481 to Ireland and 644 to the Continent in 1892. There were also exported from the same island 799½ barrels to America *viâ* Glasgow as compared with 743 in the previous season.

Weather.

The weather may be said to have been very fine for one-half and very stormy for the other half of the year. With the exception of February, fine weather was experienced generally up to the middle of September, but from this time till the end of the year, gales of wind, sometimes accompanied by heavy rain, were the prevailing features of the weather. Indeed, there was scarcely a week in which all the boats could get to sea each night, and on several occasions at the more exposed stations they only got once and twice a week. Notwithstanding the severity of the great gale of the 17th November, comparatively little damage was done in the district, the amount being about £100.

Telegraph extension.

As to the benefits derived from the extension of the telegraph in the district, there is little of special interest to report. Arisaig is too far from a fishing centre to be of any great service to the fisheries. At Coll and Tiree, the telegraph gives an advantage to the fishermen in advising sales of fresh fish, as well as that of cured cod and ling. Unfortunately, the steamer which calls at Coll does not suit the train connection at Oban, so that those fishing usually prefer going to Tobermorey with their fresh fish. It is, however, of general utility to both islands, more especially to Tiree, where about 120 of the fishermen are almost solely dependent on the fishing industry.

Campbeltown District.

Herring fishing.

The season turned out the best on record, 247,975 cwts., valued at £55,959, being landed, as compared with 160,153 cwts., valued £50,357, in 1892.

Fishing grounds. Kilbranan.

The principal fishing grounds were in the Sound of Kilbranan, off the west end of the Sound of Islay, and latterly in Loch Tarbert, Jura. As has been usual for some years past, herrings were got in fair abundance during the month of January and up to the middle of February in the Kilbranan Sound, but the regular season did not open till 1st June. The fishing continued

to be prosecuted there from that date till the close of the month of July in a successful manner, but suddenly fell off, and up to the close of the year (except during the last two weeks of December) it was a complete failure. The best shot was caught and landed by a double seine-net crew in the Sound of Kilbranan, and amounted to 120 crans, which sold at 22s. 4d. per cran.

Islay. The fishing opened in Islay about the beginning of August, and was prosecuted by a large fleet of boats. At first it did not show signs of being successful, the takes being small. As the season advanced, however, it became more regular, and heavier takes were obtained from the ground lying between Colonsay and the Sound of Islay. The herrings gradually drew into Loch Tarbert, Jura, where the boats could work with more safety, and for five or six weeks the quantity secured was the heaviest yet landed in Islay in any season. It was estimated that 25,000 crans were caught and landed during November. For a considerable time only drift-nets were used, but latterly the seine-net was employed. It was not uncommon for one circle of the seine-net to enclose a quantity of herrings which filled 5, 6, 8, and 10 boats, and as much as 500 crans were thus secured at one time, realising £220.

Loch Tarbert, Jura.

The greatest number of boats engaged at the herring fishing in Islay during the season was in week ending 21st October, when 309 were employed, manned by 1082 men and boys, 60 of the boats using the seine-net as well as the drift.

In Loch Tarbert, Jura, where herrings were never previously known to enter, those using the seine-net were the most successful for a time; but before the end of the season, the drift-net men obtained the better results.

This Loch is about 9 miles long and from ¼ of a mile to a mile broad. Its formation is irregular, and the depth of water varies from 2 to 25 fathoms, with muddy bottom. Herrings were in great abundance during November and December. The entrance to the loch is very rocky, and caution has to be observed by crews of fishing boats when entering it. For some time buying steamers were not taken inside, but in due course a channel was found which enabled them to get in and purchase the catch on the fishing ground. It was estimated that upwards of 2500 crans (in the first week of November) had to be thrown overboard owing to stormy weather, the boats being unable to get to the Sound of Islay where the buying steamers were at anchor.

There was apparently a scarcity of herrings on the Loch Gruinart fishing ground, the takes being extremely small. The larger sized boats left that loch and prosecuted the fishing off the Sound of Islay, and only the smaller sized boats remained, and made a poor catch.

There were caught and landed from Kilbranan Sound 17,441 crans and 53,409 crans at Islay, making a total of 70,850 crans of herrings for the district, showing an increase of 25,092 crans as compared with 1892.

A good many crews earned from £100 to £200, while others reached £300 and £400 for their season's work. The average earnings per man was about £40. It may be mentioned that at least one-third of the fishermen of the district are employed at

fishing for only 4 to 6 months annually, being engaged as crofters and ordinary out-door labourers during the rest of the year. The remaining two-thirds are engaged at fishing all the year round, so that the average earnings to them would be about £60 per man.

No herrings were exported direct to the Continent, but a large quantity was shipped coastwise from Islay to Glasgow, and thereafter exported.

The quality of the herrings was excellent throughout. The price in the early part of the regular season at Campbeltown and Carradale ranged from 30s. to 40s. per cran and at Islay from 16s. to 22s., but in the latter part of the season in Islay, it was only from 2s. to 8s. per cran, which thus made the value of the season's catch much under that of the previous year. The total value was estimated at £55,959.

During the season as many as 9 buying steamers were employed at one time or another conveying herrings from the fishing grounds in Kilbranan Sound, Islay Sound, and Loch Tarbert, Jura.

The weather during the summer months was all that could be desired. During October, November, and December, however, it was exceedingly boisterous, and caused much loss of boats and material to those crews who were employed at the herring fishing. The gale of the 17th and 18th November deserves special notice. Upwards of 300 boats were employed at the fishing in the Sound of Islay at that time. Unfortunately they were lying on the beach or at anchor in exposed creeks when the full force of the gale was felt. Sixteen of their number were totally wrecked, while 9 more were greatly injured, and some less so. The loss of boats and gear was estimated at £1207. The number of boats totally wrecked during the season was 28 and the same number damaged; whilst the loss of nets, lines, &c., amounted to £635. The total loss on boats, nets, lines, &c., was estimated at £2088.

A number of gentlemen in Campbeltown formed themselves into a committee to raise a fund to help those fishermen belonging to Campbeltown who had suffered loss in boats and material, and in a short time upwards of £480 was subscribed for the purpose of providing new boats and repairing others.

No lives were lost in the more severe gales, but three were lost during the year, two of these by the foundering of a Portellen line boat near the Mull of Oa, and one by being washed overboard, off the entrance to Loch Tarbert, Jura.

Those boats belonging to Campbeltown, which at one time were engaged in beam-trawling, were not fitted out during the year. This was owing to the prohibition of trawling in the Firth of Clyde.

Two new boats built in Campbeltown comprised all the boat-building in the district during the year.

The net factory hands were kept at full-time employment, and many orders are still on hand. These orders are from all parts of the east and west coast, and even from Newfoundland.

No herring barrels were made in the district. District curers purchased chiefly from various stations on the east coast, the price being 2s. 9d. to 3s. per barrel, f.o.b.

The inhabitants of the south end of Islay (Portnahaven and Portwemyss) would greatly benefit by the extension of the telegraph, and a movement was made to induce the Post Office to extend the wire to those places, but so far it has not been successful. Telegraphic extension.

The white fishing was prosecuted by 285 boats, manned by 855 men and boys, which included 24 or 25 boats which were engaged at the herring fishing also.

The cod and ling fishery at Campbeltown has not been so successful as in previous years, but in Islay and Gigha it was fairly prosperous; and fishermen, as a rule, were well satisfied with the season's work. Cod and ling fishery.

The quantity landed in the district in 1893 was 8841 cwts., valued at £3716, as compared with 9330½ cwts., valued at £3372 in 1892.

The haddock and whiting fishing was successfully prosecuted at Campbeltown in the early part of the year, but in the latter part the fish seemed to be scarce both on the inshore and offshore grounds. Turbot and halibut were very scarce on the ground where usually got. Flounders were plentiful at Campbeltown as well as in Lochindaal, Islay, the principal grounds where those fish were found. Haddock and whiting fishery.

At the former station, the seine-net is used, and proves a successful means of securing flat fish. At the latter place the line alone is used. The quantity landed in the district in 1893 was 4534¾ cwts., valued at £3807, as compared with 5860¼ cwts., valued at £4370 in the preceding year.

Eel and skate were got only at Campbeltown in any considerable quantity. At the other creeks and stations they were scarce.

The aggregate value of white fish landed amounted to £9328, an increase of £487 as compared with the preceding year.

Mussels are becoming scarce on the Dhoirlinn of the Island of Davaar, owing to the ground being disturbed while other kinds of shell-fish are being gathered. This part of the coast, if protected, would yield mussels sufficient for the locality; but, as it is, a considerable quantity has to be imported. Lobsters were fairly abundant in the neighbourhood of Sanda, Machrihanish, Gigha, and the Islands of Islay and Jura. Crabs were got about the Mull of Kintyre, and used as a bait for the lobster fishing. The demand is so slack, and the encouragement to prosecute this branch of the industry so meagre, that little time is spent looking for crabs. Cockles are numerous about Loch Gruinart, but there is no systematic gathering of them. They are of a very superior kind, and would take well in the market. Clams are not fished for, although plentiful in Kilbranan Sound. Oysters are got occasionally at spring-tide low-water about Campbeltown Loch by those who are engaged at the whelk gathering. They are also numerous in Loch Tarbert, Jura, where the proprietor cultivates and preserves them for his own use. Whelks were abundant on the coast in Kilbranan Sound, and at the Islands of Jura and Colonsay. Large quantities were shipped weekly from the latter place. Shell-fish.

Inveraray District.

The produce of the Lochfyne herring fishing for the year showed a decrease of 9368 crans as compared with 1892. The catch, however, compares favourably with former years, and is fully 10,000 crans above the yearly average catch. With the exception of 1441 barrels cured, all were despatched direct to market in a fresh state.

The fishing opened on the first of June and was continued till the close of the year, at which time herrings were plentiful in the loch. The best results were got in July, August, and December, while the yield was fair in June and November, but very little was done in September. October was, however, the most unproductive month of the year.

The number of boats employed varied from 295 in the early part of the season to about 200 towards the close, this falling off being caused by the departure of a number of boats for the west lochs and Islay fishings. About one-half of the fleet usually fished with seine and the other half with drift nets; but occasionally nearly two-thirds used the former. The practice of changing from one mode of fishing to another was not so much in vogue as during 1892, and, upon the whole, the drift-net boats yielded better results than those using the seine-net.

When the fishing opened on the 1st of June, light takes were got all over Lochfyne, but there was every appearance of herrings being plentiful in the loch. The boats fishing from Tarbert occasionally secured good takes to the north of that place, but by the close of June the fishing became more general to the north of Tarbert and in the neighbourhood of Ardrishaig.

During the first two or three weeks of July a good drift-net fishing was made in the upper loch, between Otter and Minard; but up till the close of July, the seine-net boats got their best catches in the lower loch, between Tarbert and Ardrishaig. By the beginning of August, however, the fishing had practically closed in Lower Lochfyne, and thereafter till the close of the season it was confined to the upper loch.

In the month of August both modes of fishing were successfully prosecuted between Minard and Inveraray, where several dense shoals of herrings appeared to have settled. Light takes were got to the north of Inveraray, and near the head of the loch.

Fair results were got in the first week of September, but thereafter till the close of October very little was done. A good many of the seine-net crews fished for seven or even eight weeks without getting a single take. The drift-net boats were, however, more fortunate, and usually secured light takes by fishing with a few nets at a depth of from 25 to 35 fathoms. When the strong hemp ropes were in use some 30 or 40 years ago, good fishings were frequently made at a greater depth, but the fine cotton ones now in general use will not lift any great quantity of fish from very deep water. Although very little was done in September and October, the fishermen were encouraged to persevere by the appearances indicating that a great body of herrings was lying dormant in deep

water between Minard and Inveraray, and might come to the surface or strike the shore at any moment.

The fishing again improved in the first week of November and continued good, although partial, till the close of the year. The herrings now commenced to move their quarters and frequently got into shallow water, where immense takes were secured by both modes of fishing. The largest hauls were, as usual, got by boats using the seine-net.

Towards the close of the year a partial fishing was occasionally made between Furnace and Kenmore, and one night part of a dense shoal entered Loch Shira, Inveraray, when a number of Tarbert seine fishermen, who chanced to be in the neighbourhood, secured big hauls. By next night, however, the herrings had drawn off the shore again into deep water, and for the remainder of the season the fishing was confined to the neighbourhood of Minard. In the last week of the year a seine-net crew had a take of over 500 boxes, or about 250 crans, off Minard, being the highest of the season. Single catches ranging from 50 to 200 crans were, however, frequently got with seine-nets.

A large proportion of the season's catch consisted of fish of a superior quality and size, but considerable quantities of mixed, small, and very inferior fish were frequently landed.

Prices varied a good deal. In June and July large herrings of superior quality frequently realised from £3 to £4 per cran, and during the remainder of the season good herrings readily sold at 20s. to 30s. a cran. Towards the close of the year considerable quantities of inferior fish realised only from 4s. to 10s. a cran, so that the average price would not exceed 20s. per cran.

Weather.

The weather upon the whole was favourable. Towards the close of the year, the seine-net boats were occasionally prevented from working; but unless the wind blows with hurricane force, drift-net fishing is not interfered with in the sheltered parts of Upper Lochfyne, and as soon as the wind abates, the seiners are also able to fish, there being no heavy seas to contend with.

Fish landed.

Most of the herrings were caught in Upper Lochfyne, in the neighoburhood of Minard, and landed at Glasgow. The bulk of those taken in 1892 were also obtained in the same locality. A considerable quantity was also got in the upper loch in 1891, and a few crans in 1890. But from the year 1862 down to 1890, the fishing was practically a failure in Upper Lochfyne.

The aggregate takes of the drift-net boats, with a crew of 2 or 3 men, ranged from 80 to 160 crans, and the average earnings per man from about £45 to £50 for the season.

The catches of the seine-net crews (8 men to two boats) varied very much; in fact, more so than in any recent season. A number of Tarbert and Ardrishaig crews fished the whole season through, and caught only about 100 crans, whereas a good many crews fished from 1000 to 2000 crans, the average being from 500 to 800 crans for the season. The earnings, consequently, also varied greatly, but the average per man for the season would be £45.

White fishing.

The white or line fishing opened in January and closed in May. It was prosecuted by only a small proportion of the fishermen, and never with much perseverance or success. The number of boats

employed varied from 15 to 25, and they fished from Ardrishaig, Tarbert, and Minard. The total value of the different kinds landed amounted to £2200, being about the same as in former seasons. The principal kinds of fish caught consisted of codlings, haddocks, and whitings. Very few large cod or ling were secured, and none of the other large-sized deep-sea fish, and but very few flat fish. A large proportion of the catch was retailed locally at 1d. to 2d. a pound, the remainder being sent to Glasgow and Greenock. The prices for those sent to Glasgow varied from 10s. to 13s. a cwt.

Mackerel. As in former seasons, most of the mackerel taken were secured during the herring fishing season by seine-nets when fishing for herrings, a few being also caught with nets set along the shore. The quality was usually very good. There is no regular mackerel fishery, but when herrings are scarce, fishermen engage in mackerel fishing. The total quantity caught amounted to 1208 cwts., valued at £977, being a slight decrease as compared with 1892.

Shell-fish. The total value of the different kinds of shell-fish taken showed a decrease of £283 as compared with the preceding year. This was caused wholly by the quantity of oysters lifted from the beds in West Loch Tarbert being smaller than usual, owing to the owner having decided to allow the beds a year's rest. The quantity landed during the year was 555 hundreds, valued at £278. The quality was superior.

Lobsters. This fishing is carried on along the west side of the district, from Easdale to Loch Kylesport. The value of those caught during the year amounts to £385 as compared with £338 in 1892. The number of boats employed varied from 10 to 16, the crews being often otherwise engaged.

Whelks. The quantity gathered during the year amounted to 2650 cwts., valued at £584, being a slight decrease as compared with 1892. Almost the whole of these were sent direct to London.

Mussels. Nearly all the mussels got were used for bait. They are fairly plentiful in the district, but none are exported, and no attention is given to cultivation.

Boats fishing in other districts. In the early part of the year, about twelve pairs of seine-net boats went to Girvan for a few weeks, but did little or nothing. A few drift-net boats went to Lochboisdale in May, where also very little was done. At the fall of the year a number of boats, both seine and drift, went to the west lochs, Islay, and Tarbert, Jura—and were all successful.

Rothesay District.

The decrease in the value of the fish landed in 1893 as compared with 1892, amounting to £713, was due principally to the low prices obtained for herring.

The herring fishing season opened on the 1st of June, but a general start was not made until the beginning of July. The fishing terminated practically in October. A few boats, however, were employed up to the middle of December. The fishing in

Loch Long, Loch Striven, and Lochriddon, which is generally prosecuted during the months of June and July, was this season a comparative failure. The principal fishing grounds were off Ardlamont and Skipness Point, and in Kilbrannan Sound.

Several drift-net crews (3 men) grossed £70; but the earnings of the bulk of the fleet did not exceed £45. Four boats were for a short period employed with seine or trawl nets, which method of fishing proved somewhat unsuccessful.

The catches were light and exceedingly partial throughout, and the quality and size of the herrings were rather variable. During the summer months as much as 60s. to 80s. per cran was obtained, but towards the end of the season prices fell to 10s. and 15s. The average price for the year was 22s. as compared with 28s. in 1892. This fall in price was due to the large supply of fresh herrings placed in the markets from other districts.

Owing to the dry season, the water was exceptionally clear, which was against the success of the fishing; but it does not appear that any large shoals of herring had visited the waters of this district during the year.

Twelve boats participated in the herring fishing at Islay, one at Loch Hourn, and one at Ardglass, Ireland, and all are reported to have earned from £70 to £100 each.

Five vessels fitted out with barrels and salt for curing herrings in the North-West Highland lochs, and with the exception of one which was totally wrecked on the coast of Skye, all returned with full cargoes. These herrings were disposed of principally in Glasgow, Greenock, and Ayr, and a few were bought up for local consumption at prices varying from 14s. to 25s. per barrel. Curing vessels.

From the middle of August to the middle of September some excellent catches of from 5 to 22 boxes of mackerel were got by two or three local boats, which happened to follow up the shoals and landed their takes in other districts. These were secured off Ardlamont Point, Inchmarnock Island, and also off Mount Stuart, Bute. Mackerel are very much attracted by light, and prefer a stony or rocky bottom to sand. Mackerel fishery.

A large proportion of the cod taken consisted of small cod (codling); but these met with a ready sale at prices varying from 13s. to 16s. per cwt. Cod fishery.

The decrease in the quantity of ling landed, which amounts to 122 cwts., is accounted for chiefly by the fishermen being occupied with other employments during the year. The bulk of the ling are generally caught on the north coast of Arran. Ling fishery.

Haddock were generally of a good size and of excellent quality. The most successful fishing ground was near the entrance to Lochfyne, and also between the Bute and Cumbrae Islands. Haddock fishery.

The quantity and value of whiting landed show a falling off from 1892 of 812 cwts. and £643 respectively. The best catches were obtained during the spring and summer months. The fish were generally of a small size, but quite marketable. The principal whiting ground lies between 1 and 2 miles off Skipness Point. Shoals of small whiting visit the district during the summer months, but their movements are quite irregular. Whiting fishery.

With the exception of 76 cwts. landed by beam-trawlers, all the

flounders, plaice, and soles were taken with the seine-net and with lines in the shallow waters of the district. There were two beam-trawl vessels of 6 tons burden employed at this fishing, one having only been fitted out in the latter part of the year.

Eel fishery. This fishing was not quite so successful as in 1892. The fish caught were readily bought up and forwarded to the English markets, the best catches being got in the Kyles of Bute and Loch Long.

Saithe fishery. A decrease of 146 cwts. in quantity and £62 in value was exhibited in the return of saithe landed. This fish is taken at nearly all the creeks in the district. At many stations it is of little value.

Shell-fish. The principal kinds of shell-fish taken were mussels, lobsters, whelks, and cockles. At several creeks small patches of the foreshores produce mussels, but the principal beds are in Lochriddon Holy Loch, and Loch Long.

Oysters are almost extinct on this coast, only 400 being landed during the year. These were got in the vicinity of Inchmarnock Island during spring tides. On account of their large size they are known as rock oysters.

Fishermen's Earnings. As a large quantity of the herrings got is landed at the different creeks by boats belonging to other districts, it is only an approximate estimate of the average earnings of resident fishermen that can be given, and this amounts to about £45 per crew of 3 men. At the white fishing there were from 160 to 170 fishermen occasionally employed. The value of fish landed by them, exclusive of herring and mackerel, amounted to £3085, their average earnings being thus about £19.

Telegraphic extension. The extension made to the stations of Lochranza and Pirnmill, Arran, in 1888, under guarantee from the Board, has for the last few years been self-supporting. It has been a great boon to the fishing industry, and a source of benefit to the district generally.

Greenock District.

Herring fishery. A partial commencement of the herring fishery was made in the week ended 3rd June, when 16½ crans or 40 cwts. were landed, and it continued to be prosecuted till about the middle of September.

The total quantity of herrings landed throughout the year shows an increase over the preceding year of 2317 cwts. and of £63 in value. The fishing was prosecuted at the stations on the Ayrshire coast and in Gareloch.

Saltcoats was the most productive station, yielding 2393 cwts., valued at £1141, Largs coming next with 1348 cwts., valued at £411. The greatest number of boats employed in the fishing at one time during the season was 66, being 16 less than in 1892. All the boats used drift-nets.

The most productive week of the fishing was the week ended 15th July, when 705 cwts. were landed. The highest individual take for a night's fishing was composed of 10,000 herrings, equal to 10 crans.

The quality of the herrings all through the fishing season was indifferent, while the size was small. The average price per cwt. is estimated at 9s. The catch, as usual, was all disposed of in a fresh state. The weather took an unfavourable turn at the beginning of August, and continued rather stormy all through the remainder of the season.

There were two curing vessels fitted out for the herring fishery during the year, and there was landed from them, and other vessels engaged in the industry in the North-West Highlands, a total of 15,131 barrels, or an increase over the previous year of 69 barrels. These herrings were mostly transferred to the various trading and chartered steamers, direct from boats at the fishing grounds situated chiefly in the districts of Campbeltown and Loch Carron and Skye. Prices of cured herrings ranged from 17s. to 26s. per barrel, the average price being 20s.

Herring and cod and ling exportation.

The total export of herrings showed an increase of 1342½ barrels over the preceding year; while the total quantity of cod and ling exported had increased by 10,187 cwts. The bulk of the export was sent to Ireland. All the fish exported were cured and dried in other districts on the east and west coasts of Scotland.

Beam-trawl vessels.

There are 17 small sailing beam-trawl vessels belonging to the district, of an average value of about £24 each. Their trawl-nets, including beam and irons, are valued at £9 each, and each vessel has on an average 2 nets. They landed during the nine months of the year in which they are permitted to fish, 1362 cwts. of flounders valued at £1404.

Boat-building.

There were no fishing boats built in the district in 1893, but there were 13 steam beam-trawl vessels constructed at Govan, on the Clyde, for Hull and Grimsby owners, at a cost of about £4000 each.

Ballantrae District.

Herring fishery.

In this district there is both a winter and a summer fishing, the former being the more important. There are three modes of fishing and appliances used. These are the ordinary drift-net, the set trammel-net, which is mostly used by the local fishermen when the herrings settle on the banks to spawn, and the seine or circle net used by the Argyleshire fishermen.

Winter fishing.

The success of the winter fishing depends very much on the state of the weather, the whole fishing ground being exposed to the full sweep of the westerly gales, which are common in winter on this part of the coast.

The fishing usually commences in November and is in full operation in the month of January, and continues till the end of March.

In 1893 the weather was most unfavourable for winter fishing. From the beginning of January till near the end of that month, the boats remained on shore, and no herrings were landed during the month. In February, when the boats were able to get to sea, there was no appearance of herring on the banks or on the south fishing ground, and the Girvan and Ballantrae crews commenced

working gill-nets and great-lines for cod, using Norwegian iced herrings as bait.

In the second week of February stormy weather again set in and prevented the prosecution of both the herring and cod fishing.

The first herrings of the season from the Ballantrae banks were landed on 16th February, and for the three remaining days of the week 175 crans, consisting mostly of spent herrings, were landed by 23 trammel-net boats.

The seine and trammel-net boats were on the banks together for the first time in the season on 21st February. Two pairs of seine boats landed 31 crans of very good herrings, and these were the first and only herrings caught by the seine fishermen during the year. Though out on the banks for several nights afterwards, they failed to meet with herrings, and, with the exception of these two pairs, all the crews returned to their homes without earning a single shilling.

It fared very little better with the trammel-net boats, their whole season consisting of only seven nights' fishing, and their catch of 389 crans.

The weather in the early months was stormy; herrings were late in coming on the banks, or if on the banks, were missed; and the fishing was consequently a pronounced failure.

Forty-eight trammel and 56 seine-net boats were engaged in the fishing, and the total catch from the Ballantrae banks was 389 crans, valued at £319, by trammel-net boats, and 31 crans, valued at £25, by seine-net boats, the average price per cran being 16s.

There was no drift-net fishing.

As compared with some previous years, the results were most unfavourable. In 1884, 443 boats landed a total catch of 14,564 crans, valued at £43,692; and in 1883, the best season on record, 400 boats landed 24,575 crans, valued at £80,000. Since 1887, the fishing has shown a marked downward tendency.

Summer fishing.

The summer herring fishing on the Ayrshire coast commenced in the beginning of May and ended in August, and in Luce Bay on 20th May and closed in the first week in July.

The fishing was light, especially in Luce Bay. Herrings do not congregate in shoals in the Firth of Clyde in summer, and the catches consequently amounted only to hundreds. Prices were uncommonly high, as much as 15s. and 20s. per 123 herrings being paid at Sandhead and Glenluce, and from 6s. to 9s. at Girvan. No herrings were cured, the catches both in summer and winter being disposed of fresh.

The highest number of boats fishing, who used only drift-nets, was 68, and total catch 998 crans. In June the herrings were of fair average size; but in July and August they were small.

Mackerel ng.

Mackerel appeared on the fishing ground off the Ayrshire coast early in August and remained till September. The fish were of unusual size for this locality, and were readily sold at 1s. 6d. and 1s. 9d. der dozen. They were taken chiefly by hand-lines. The total quantity landed was 776 cwts., valued at £549, as against 175 cwts., valued at £123, in the previous year.

Cod fishing.

The cod fishing is prosecuted usually from January to April. At Girvan, Carleton, and Ballantrae gill-nets and great-lines are

used in their capture, while at Stranraer and Portpatrick, where the water is deeper and the tides stronger, great-lines and hand-lines only are employed.

The fishing was a good deal interrupted early in the year by stormy weather and want of bait. Herrings for bait were brought from Norway in boxes iced, costing about 15s. per box of 600. The total weight of cod landed was 9481 cwts., valued at £4190, compared with 8741 cwts. and £3752 in 1892. The fish were of fair average size, and the quality was excellent.

On the Ayrshire coast the fishermen are now prosecuting the cod fishing to a greater extent than previously, and since beam-trawling was stopped in the lower reaches of the Firth of Clyde, they are using a better class of boats, and a larger quantity of fishing gear.

Haddock and whiting.

Next in importance are the haddock and whiting fisheries, the total catch of haddocks being 3141 cwts., valued at £2306, as compared with 3822 cwts. and £2609 in 1892, and of whiting 2428 cwts. valued at £1767, as against 3478 cwts. and £2396 in the preceding year.

The haddocks throughout were of good size and quality, but whitings were small and inferior.

Turbot.

Turbot are got chiefly at Girvan and Ballantrae with gill-nets set on the sea bottom in a similar manner to herring trammel-nets. The catch was slightly under that of the preceding year, being 142 cwts., valued at £349, against 169 cwts. and £374 in 1892.

Flounders.

Flounder fishing is prosecuted all over the district from August to January, and the appliances used are the small-line, flounder-net, and beam-trawl. Fifty-one small smack-rigged vessels of about 5 tons each from Annan were employed in beam-trawling in the Solway, and their total catch was 2232 cwts., valued at £1431. Besides those captured by the beam-trawl vessels, a good quantity was taken by the stake-nets set along the shores of the Solway from Powfoot, and worked by the ebb and flow of the tide, the fish dropping into the pockets or bags with the receding tide.

The total catch and value of flounders landed was 2232 cwts., valued at £1431, by Annan trawlers; 834 cwts., valued at £389, by stake-nets on the Solway; 327 cwts., valued at £224, in Luce Bay by flounder-nets; and 1570 cwts., valued at £1629, at all the other stations. Total catch of flounders 4963 cwts., valued at £3673, against 5669 cwts., valued at £3666, in 1892.

Shell-fish.

The principal kinds are shrimps, caught in the Solway, and oysters in Lochryan.

The same vessels that are employed in the flounder fishing at Annan are also engaged in shrimping with the trawl during the season, which is from February to June. It is an interesting fishery, and the most extensive and valuable of its kind in Scotland.

From Annan, 51 cutter-rigged smacks, with 2 men in each, are engaged in it. They work with a small meshed beam-trawl.

Unloosing their moorings at the Water-foot, Annan, with the first of the ebb tide, the net is cast, and the vessel drives with the tide a distance of 8 or 10 miles seawards. The returning tide

brings them back over the same ground. The shrimps caught are boiled at sea, and about 30 tons of salt is used during the year in the cooking process. There were 1343 cwts., valued at £1200, landed last year, as compared with 1713 cwts., valued at £1733, in 1892.

Oysters. The principal oyster fishery is in Lochryan, and is the property of Mr John Wallace. The catch for the year in Lochryan was 2088 hundreds, valued at £948. One hundred and seven hundreds were landed at Drumore and 120 hundreds at Garlieston. Total for the year 2315 hundreds and £1037 against 1774 hundreds and £828 in 1892.

Lobsters. The next in point of value were lobsters, which yielded a total of 168 hundreds valued at £555 against 106 hundreds and £379 in 1892.

Mussels. Two thousand three hundred and eighty cwts. of mussels, valued at £170, were gathered from the scalp at Creetown, chiefly by fishermen from Morecambe Bay, and sent into England for consumption. The total value of shell-fish landed is £3430 against £3577 in the preceding year.

The total value of white and shell-fish landed in 1893 was £20,003 against £23,931 in 1892.

Marine superintendence. During the season a telegram was received by the officer from his Ballantrae correspondent, reporting a trawler working within the limits. This information was at once communicated to Captain M'Donald in Lochryan, who succeeded in capturing the steam-trawler 'Goeland,' the master of which was convicted at Campbeltown.

The practice on this coast of leaving nets and lines set in the sea makes it difficult to recover damages for loss of the same, or trace the party who may have committed the damage; but upon the whole, the fishermen on the Ayrshire coast have now great freedom and comparative comfort in prosecuting their calling, and, apart from the ordinary wear and tear of boats and fishing gear, no serious damage or loss falls to be recorded, and there was no loss of life.

APPENDIX P.

DEVELOPMENT OF A SCOTTISH MACKEREL FISHERY.

WASHINGTON,
5th December 1893.

MY LORD,—I have the honour to report that, in compliance with the instructions contained in your Lordship's despatch of the 17th ultimo, I have directed Her Majesty's Consul-General at New York, and other consular officers in the United States, to furnish reports upon the American mackerel fishery and trade as carried on in their respective consular districts.

As, however, some time must necessarily elapse before these reports can be sent in, I thought it desirable at the same time to communicate with the United States Fish Commission on the subject, and the Commissioner, Mr Marshall M'Donald, has very courteously furnished me with the inclosed report, which contains valuable details respecting the points upon which the Scotch Fishery Board especially wish to be informed.

With regard to the desire expressed by the Board to establish a trade in Scottish-cured mackerel with the United States, your Lordship will observe that the Commissioner states, in the course of his report, that in recent years the catch of mackerel in the United States has not been sufficient to supply the demand, and that large quantities of mackerel have been imported from Norway, Ireland, and the British Provinces of North America.

Under these circumstances, there would seem to be no reason why the Scottish Fishery Board should not succeed in establishing the trade they desire.—I have, &c.,

(Signed) JULIAN PAUNCEFOTE.

The Earl of Rosebery, K.G.

U. S. COMMISSION OF FISH AND FISHERIES.

WASHINGTON, D.C.,
5th December 1893.

Mr E. Goschen,
First Secretary, British Embassy,
Washington, D.C.

SIR,—Complying with your recent verbal request, in behalf of the Scotch Fishery Board, for information concerning the mackerel fishery of the United States, I take pleasure in furnishing the following answers to the questions contained in the memorandum left at this office; certain other data, on the same subject, that may be of some interest, are likewise given. I also send, under other covers, several reports relating to the mackerel fishery, issued by this Commission.

(1) The mackerel fishery of the United States is at present prosecuted by about 200 vessels sailing from ports in Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. On nearly all the larger vessels the apparatus employed is the purse-seine; the smaller vessels and a few large schooners use gill-nets and lines, which are also the regular means of capture on the small open boats fishing on the coast of New England. Large quantities of mackerel are taken in sedentary fisheries in Maine, Massachusetts, Rhode Island, New York, and New Jersey; but the yield is much smaller than that resulting from

the vessel fishery, and in most localities mackerel is only an incidental element in the catch, the pound nets, weirs, and traps being operated chiefly for other fishes.

(2) Nearly all the mackerel taken in weirs and traps operated from or connected with the shore, and a large part of the fish caught by small vessels and boats, are sold fresh in New York, Boston, Portland, and other coast cities of New England, whence they are shipped in ice by dealers to various parts of the country. The vessels using seines, and those employing lines in the offshore fisheries are fitted out with salt and barrels, and land the fish in a fresh condition only when catches are made in the vicinity of a suitable market. The mackerel are preserved by splitting them down the back, removing the viscera, and placing them in pickle, where they remain without further attention until landed, when they are sorted and re-packed in barrels, half-barrels, and kits. The great bulk of the salt mackerel prepared in the United States is consumed locally. The catch of mackerel in the United States in recent years has not been sufficient to supply the demand, and large quantities of salt mackerel have been imported from Norway, Ireland, and the British Provinces of North America.

The prices received for salt mackerel vary with the season, the supply, the demand, and the quality and size of the fish. During the present season the wholesale prices of native fish have ranged from $9 to $30 per barrel of 200 lbs., averaging about $15. The quotations of the New York Market at this time (December 4), are as follows :—

Where Packed.	Size and Quality.	No. of Fish in Barrel.	Wholesale Price per barrel.
New England, . . .	No. 1	210	$23.50
New England, . . .	No. 2	290	17.50
New England, . . .	No. 3	250	14.00
British Provinces, . . .	No. 2	270	17.00
Ireland, ...	No. 1	—	16.00
Norway, ...	—	150	30.00

(3) No special efforts have been taken to develop the fishery. In 1887, a federal law was enacted, prohibiting, for a period of five years beginning in 1888, the landing of mackerel caught before June 1 ; this, however, was a trade measure rather than a procedure to give protection to the fish or to promote the industry. There are now no restrictions of any kind on the prosecution of this fishery.

(4) The mackerel fishery of the United States has been almost a failure since 1886, although the present year has shown a small improvement over the last, and has been the best in seven years. In 1885, the catch of salt mackerel in the country was about 400,000 barrels ; in 1892 it was only 50,000 barrels.—Very respectfully,

(Signed) MARSHALL M'DONALD,
Commissioner.

WASHINGTON,
4*th January* 1894.

MY LORD,—With reference to my despatch of this series, of the 5th ultimo, I have the honour to transmit, herewith, to your Lordship, two reports which have been drawn up by Her Majesty's Consul-General at New York, and Her Majesty's Consul at Boston respectively, upon the American mackerel fishery and trade as carried on in their consular districts.

These reports contain answers to the specific questions upon which the Scotch Fishery Board particularly desired information.

As regards the prospects of establishing a trade in Scottish-cured mackerel with the United States, concerning which special particulars were required by the above Board, it will be seen from these reports that, if proper care is taken in curing and packing the fish, there is no reason to doubt that a very profitable trade could be established.

As your Lordship will perceive from the concluding paragraphs of Mr Booker's report, the consignments of mackerel that have reached the United States from Scotland have been found to be the finest that have been shipped from any part of Great Britain, and that, in the opinion of the trade, if mackerel from Scotland are prepared in the same careful and neat manner as the Scotch herring which are shipped to this country, they will meet with a ready sale in the United States market.

Mr Yeats Brown, Her Majesty's Consul at Boston, arrives at the same conclusion, stating that Boston would probably absorb, at satisfactory prices, any quantity of cured mackerel that could be shipped from Scotland; but he also draws attention to the fact that it is absolutely necessary that the fish should be in first-rate condition—well cured and neatly packed, pointing out that the United States is not a suitable market for any but first-rate goods.

It was, he states, because the Irish curers did not fully realise this fact, that they failed for so many years to secure a firm hold of the United States market, and he observes that even now, though their fish is more readily sold than formerly, it is considered inferior to the Norwegian, not because the latter fish is finer, but owing to the fact that it is treated with greater care, more thoroughly salted, and packed in good tight barrels which do not leak and let the pickle escape.

Mr Yeats Brown's report also contains statistics as regards the United States mackerel trade, which will doubtless prove of great interest to the Scotch Fishery Board.—I have, &c.,

(Signed) JULIAN PAUNCEFOTE.

The Earl of Rosebery, K.G.,
&c., &c., &c.

REPORT ON AMERICAN MACKEREL FISHERY AND TRADE WITHIN THE DISTRICT OF THE NEW YORK CONSULATE-GENERAL.

There are no mackerel cured in the States of my district, New York, Rhode Island, Delaware, Connecticut, and New Jersey. Mackerel in small quantities are caught and cured at many places on the coasts of Maine and Massachusetts, but the great bulk of the American catch are cured at Gloucester (Massachusetts), Portland, Maine, and some points on Cape Cod (Massachusetts).

From these curing stations the mackerel are sent to New York and Boston, which are the distributing points for the whole country.

Most of the mackerel caught near the shore are landed and consumed fresh. As a rule, those salted and cured are caught at some distance from the coast, and are taken by vessels fitted expressly for the business.

Large quantities of mackerel have been coming to the New York and Boston markets for many years from Nova Scotia.

The quality and cure of these fish have been inferior to those cured in United States ports, and they have brought lower prices; and for the past year or two the Nova Scotia mackerel have been in great measure supplanted by the Irish fish, the quality, flavour, and cure of the Irish fish being generally better than that of the Nova Scotia mackerel, and

suiting the American trade better. Prices for Irish mackerel, the past season, have ranged from $11.00 to $15.00 per barrel, according to quality and demand.

In preparing salted mackerel for the American market, they should be smoothly split on the back as soon as possible after being caught, to prevent their becoming soft.

After splitting they should be soaked in clear sea-water until the blood has been soaked out, but care should be taken not to leave them in the water long enough to soften or taint the fish. After the blood is soaked out, the fish should be rimmed, which is, to make an incision on the inside of the backbone, alongside the belly part, and a corresponding incision on the opposite side of the belly, the effect being to show the fatness of the fish.

The fish should then be thoroughly struck with salt, care being taken to see that every portion of the fish is covered.

When salting in barrels they should be packed with the skin down, a layer of fish and a layer of salt alternating, until the barrel is full. They should be allowed to stand until thoroughly struck through with salt, so that the fish will not shrink in weight, then repack in barrels, putting in new salt and pickle, packing from 205 to 210 lbs. in each barrel, or enough over weight to insure full 200 lbs. weight of well struck fish to the barrel.

The whiter the fish are made, and the neater they are put up and prepared, the more attractive and desirable they are, and the higher price realised.

One of the most important points to be attended to in shipping mackerel to this country is the condition of the barrel. The best Scotch herring barrels that can be obtained, should be used to insure the mackerel arriving here in good condition and full of pickle; if the pickle gets out, the fish stain, become rusty, and are almost worthless. Poor barrels, and consequently rusty fish, is the principal trouble the trade has to deal with in handling foreign mackerel. Some lots have come here from Ireland with 50 per cent. rusty, and consequently worthless.

Too much care cannot be given to this.

There have been no recent attempts to increase the fishery on the Atlantic Coast.

Improved appliances were tried some years ago, and, many expert fishermen think, resulted in decreasing the catch.

The comparative failure of the mackerel fisheries for the past ten years induced the merchants to look abroad for fish. Since then the arrivals of mackerel from Europe, principally from Norway and Ireland, have been steadily increasing, until now they have become a prominent factor in supplying the markets of the United States.

The Norwegian mackerel being larger, fatter, and more carefully prepared, have commanded the highest prices, and have been sold here as high as $35.00 per barrel.

They have taken the place of the '†1's' here. The Irish mackerel, being a cheaper fish, having commanded a larger market than the Norways, and have taken the place of the '‡2's,' and have to a great extent driven the Nova Scotia fish out of the market.

The foreign mackerel have been growing more popular, the demand for them has been increasing, and there is no apparent reason why the trade and scale should not continue good, provided the curers and shippers take proper care in preparing and shipping their goods.

Several lots of mackerel have been shipped here recently from Scotland, and, with one or two exceptions, they have been the finest that have come here from any part of Great Britain.

In the opinion of the trade who have handled Scotch herring, it is thought that if the mackerel are prepared with the same care and thorough manner and neatness that Scotch herring are put up, that their mackerel will meet with a ready sale in this market.

(Signed) W. L. Booker,
H.M. Consul-General.

Report on the Mackerel Fishery and Trade in the New England States, in reference to Queries from the Scotch Fishery Board.

Boston is the great distributing centre for the fish trade, and deals with the whole catch of fresh fish as well as salted fish, and has almost a monopoly of the receipts of foreign fish from the Canadian Provinces, Great Britain, France, and Norway.

The statistics for the current year are, of course, as yet not made up, and I have not been able to get as complete information as I could desire; but not to delay making a report on the subject, I give such details as I have been able to collect as to mackerel, and I answer the specific questions put by the Scotch Fishery Board as far as I am able.

If the Board would put further specific questions, I would endeavour to get as full answers to them as possible, but meanwhile the following observations, which I have acquired by the help of the Boston Fish Bureau and one of the leading firms in the import trade, may be of some use.

To answer, in the first place, the specific questions put by the Board,—

(1) The mackerel fishery of this coast is carried on from as far south as Cape Hatteras right up to the coast of Nova Scotia and New Brunswick.

The mackerel strike the coast down south in March or April, and are followed up the shore, reaching Cape Cod in May or June. They come back south in the early autumn, and the last are caught up to the end of November, or, very rarely, in the early days of December.

The earliest mackerel ever landed in Boston was on the 23rd March 1881 (140 barrels from the schooner 'Edward E. Webster'); other earliest landings have been 24th March 1881, 28th March 1885, and 31st March 1881. No others ever in March, and very few in April.

The fishery may be said, therefore, to open, in a general way, in May, and not until the fish reach the neighbourhood of Cape Cod.

The modes of fishery employed are, for the salted mackerel trade mainly by schooners fitted out from Boston, Gloucester, Swampscott, and other various ports on the coast of Massachusetts and Maine, and for the fresh mackerel by trap or pound-net fishing; but, of course in those seasons when the catch by this means is so plentiful as to exceed the demand for fresh fish, these are at once salted. It must be observed, however, that the fresh fish market of Boston is vastly increased now by the facilities afforded by railways and ice storage, and fresh fish is now sent inland over a vast area, extending pretty well over the whole country, as far west as the Mississippi.

Some seasons considerable quantities are caught by small boats along the shore, but in the main the mackerel fishery may be said to be carried as above stated.

(2) The mackerel are invariably split up, most carefully salted, and put in pickle *on board the schooners*—almost, in fact, before the life is out of them, and this is the point insisted upon by all my informants as being of the utmost importance, in order to secure good and durably cured fish. The fish so brought ashore and sold, may or may not be afterwards sub-

jected to a second treatment, being sorted into bloaters, extras, and Nos. 1, 2, and 3, according to size; and, in fact, all of them were formerly so treated by the Boston dealers; but of late a certain number of the inland wholesale, as well as retail dealers, prefer to take the fish as they are landed, and do their own sorting (and fresh pickling) when they get their fish home by rail. But, in any case, it is held here that no use of ice, or speed in bringing the fish ashore, will do instead of immediate cure *on board*. There are no two opinions on the point, everyone asserting that it is of first necessity to thoroughly salt and pickle the fish the moment they are out of the water; and the rusty and unsaleable condition of much of the fish sent here from England is attributed to the neglect of this essential.

I may here point out, lest I should forget it, that it is no sort of use sending inferior fish, or, in fact, anything but fish not only sound but nice looking, to this market. The American working man does not look first and above all things to the cost of what he buys. He earns, as compared to his class in Europe, a very large day's wage, and is, on the other hand, accustomed to pay high for everything he consumes. He looks, therefore, to the goodness of things more than to their cost, and it is therefore hopeless to expect him to eat badly cured or ugly looking English fish if he can get better or nicer looking Norwegian fish by paying somewhat dearer.

Our Irish curers got no hold of this market for several years because they would not take these facts to heart, but of late they have realised the position, and their fish is each year more readily sold, though the Norwegian still 'takes the cake,' owing, not to finer fish but greater care, more thorough salting, and good tight barrels which don't leak and let out the pickle.

To illustrate the foolishness of the earlier Irish traders, one of the principal importers here tells me that, having at great length and trouble to himself written to his Irish correspondent a full description of the requirements of this market, he received a very curt answer to the effect that he did'nt want 'advice,' he 'sent the fish to be sold not to be 'criticised!'

(3) No special means have been taken to develop the industry, which rests entirely on the energy and intelligence of the very practical people engaged in it. The Fish Bureau I have alluded to is a very useful institution, but it, as everything connected with the trade, is a voluntary association of those interested. The only 'Government' interference that I have heard of was the experiment of a 'close time,' instituted for five years; but this came to an end with 1891, and opinions differ as to its usefulness.

(4) The local catch of mackerel for the last five years is stated as follows:—

1889,	Barrels,	21,918
1890,	,,	19,042
1891,	,,	47,814
1892,	,,	62,000
1893, Estimated	,,	50,000

The imports of foreign fish for 1891 and the two previous years were as follows. No later statistics are at present published:—

		1891.	1890.	1889.
From England,	Barrels,	4,570	16,953	8,860
,, Scotland,	,,	13	5	...
,, Nova Scotia, New Brunswick, &c.,	,,	44,659	54,543	27,513
,, France,	,,	865	811	...
,, Norway and Sweden,	,,	607	2,492	1,900
	Totals,	50,714	74,804	...

The imports from England are chiefly Irish cured fish; and I am told that those from France are also fish caught on the Irish Coast by French boats.

The prices of mackerel, in first hands, on the 1st instant, were as follows:—

Nova Scotia,	Extras,	per Barrel,	$18.00
,,	No. 1's,	,,	13 to 14
,,	Others,	,,	9.50 to 11
Irish, New,		,,	11 to 12
Prince Edward Island,	No. 1's,	,,	13 to 14
,,	Others,	,,	10.50 to 12
'Shore' Fish,	No. 1's,	,,	18.00
,,	Others,	,,	11 to 14
,,	Unculled,	,,	13.50
Cape 'Shore,'	,,	,,	12.00

As to markets, I have no knowledge of the relative importance of New York, Baltimore, and Philadelphia, as compared to Boston; but there is no other possible market for British produce in the New England States except Boston, which is a large and increasing market, dealing not only with the interior but with some of the West India Islands, and having, among the importing firms, several of very high standing both for intelligence and upright dealing.

In conclusion, I think I may safely say that Boston would absorb, at satisfactory prices, any such quantities of cured mackerel as Scotland would send for some years to come, if they are in first-rate condition; and that, on the other hand, it is not a suitable market for any but first-rate goods.

In order to study the quality and mode of cure best adapted, the surest plan would be for an expert to visit the best Norwegian curing and packing places; but, if this were difficult, much might no doubt be learnt from the 'Baltimore' Irish Fishery School, which has evidently had a good influence on the cure of Irish caught fish.

(Signed) M. Yeats Brown,
H.M. Consul.

Boston, 19th *December* 1893.

H.B.M's Consulate-General,
Christiania, 23*rd January* 1894.

My Lord,—After renewed application to the Norwegian Home Office, I have now the honour to inclose a report on the Norwegian mackerel fisheries, which I have prepared from materials supplied by that department.

The figures appended to the report are taken from tables published by the Central Statistical Bureau.—I have, &c.,

(Signed) A. Stewart MacGregor,
Acting Consul-General.

The Right Honourable
The Earl of Rosebery, K.G.,
&c., &c., &c., London.

Norwegian Mackerel Fishing.

The Norwegian drift-net fishing for mackerel is carried on from the middle of May till about the 10th of July.

This kind of fishing is engaged in by the inhabitants of the coast in the province of Stavanger, and eastwards as far as the Whale Islands (Hoalöerne).

The vessels employed are not large; they have a crew of from three to five men, and each one is equipped with from fifty to eighty nets.

The greater part of the catch is exported fresh and packed in ice to England and Germany, and the remainder is used partly fresh, partly salted in this country.

During recent years a new kind of mackerel fishing has been tried (it is called Dorgefiske), a kind of trolling. It is carried on during the months of August and September between the Norwegian coast and the great fishing banks in the North Sea.

The vessels engaged are from twenty to eighty tons burden, and with a crew of from six to ten men each.

The fishing is carried on in the following manner:—

Sailing at a moderate pace, from six to ten lines are hung out—some on poles—from each boat.

The bait most frequently employed is a piece of fish skin, which can be used with or without spoon bait.

As soon as the mackerel are caught they are split 'kippers', washed, and then salted in barrels.

When they are to be exported they are divided into four sorts, according to quality and size. Afterwards they are packed in fresh salt.

These fish are sent to America, and last autumn they fetched an average price of from 15 to 18 dollars per barrel (£3, 3s. 9d. to £3, 16s. 6d.) *c.i.f.*—at New York or Boston.

The total catch was 15,000 barrels.

In 1893 about 400 vessels took part in this 'Dorge' fishing (trolling). The profits for the fishermen, therefore, were not great; but as this particular kind of fishing can be carried on at a time of year when other work is scarce, the people engaged in it are satisfied with small returns.

To this may be added that the requisite apparatus is cheap and simple, only a few lines and some 'sinkers' (lead).

The vessel gets one-third of the fish, and the fishermen two-thirds.

The men find their own food.

No special means have been taken by the Norwegian Government to develop this industry, but those engaged in it can, like other fishermen, obtain loans* from the State Fund set apart for the development of Sea Fisheries.

TABLE I.

RESULTS OF THE MACKEREL FISHERIES IN 1892.

Number of fishermen.	Number who used drift-nets.	Boats with drift-nets.	Number of fish caught.	Number caught with drift-nets.	Value of catch.	Average price per 100.
3117	3003	825	2,638,880	2,560,540	£21,803	£0 16 6

* A common rate charged for loans in Norway is 5 per cent., but fishermen can borrow from the State Fund for 2½ per cent., with one year's exemption from interest. The said fund amounts to about £22,222.

(Signed) A. S. M.

TABLE II.

NORWEGIAN 'DORG' FISHING (TROLLING) FOR MACKEREL IN THE NORTH SEA DURING 1892.

No. of ships.	Tonnage.	No. of crews.	Catch packed in barrels.	Value.
307	11,278	2142	11,482¾	£29,630

Besides the above Norwegian vessels, 5 Danish boats and 60 Swedish were engaged.

GOVERNMENT HOUSE, OTTAWA,
CANADA, 23*rd February* 1894.

MY LORD,—In reply to your Lordship's despatch, of the 30th November, relative to the wish of the Scotch Office to obtain information as to the Canadian mackerel fisheries, I have the honour to forward herewith copy of an approved minute of the Privy Council, submitting reports from officers of the Department of Marine and Fisheries, which contain the information required.—I have, &c.,

(Signed) ABERDEEN.

The Most Honourable
The Marquess of Ripon, K.G., &c.

CERTIFIED COPY of a Report of a Committee of the Honourable the Privy Council, approved by his Excellency the Governor-General in Council on 13th February 1894.

The Committee of the Privy Council have had under consideration a despatch, hereto attached, dated 30th November 1893, from the Marquess of Ripon, requesting to be furnished with a report on the Canadian mackerel fisheries, for the information of the Secretary for Scotland.

The Committee, on the recommendation of the Minister of Marine and Fisheries, to whom the despatch was referred, advise that your Excellency be moved to forward a certified copy of this minute, together with its annexes, to the Right Honourable the Principal Secretary of State for the Colonies, for transmission to the Fishery Board for Scotland.

All which is respectfully submitted for your Excellency's approval.

(Signed) JOHN J. M'GHEE,
Clerk of the Privy Council.

APPENDIX I.

NORTH SYDNEY, CAPE BRETON,
6*th January* 1894.

SIR,—In reply to your circular, dated 28th December 1893, in *re* mackerel fishery in this district, I beg to report:—

(1) Mackerel make their appearance in the southern waters of this island on or about the 1st of June. The schools are then moving north,

and about ten days later reach the extreme northern waters of this island on their way to the North Bay. These fish are of a poor quality, and are known as the 'spring mackerel.' The fishermen count on from one week to ten days' fishing, and the method of taking the fish is confined to gill-nets, with the exception of three fish traps operated in Victoria County, one in Inverness County, and three ordinary seines used by the fishermen at Forchu and Isle Madame. The second run comes about the latter part of July or first of August, and are called the 'jig mackerel.' They remain on the coast until the last of September.

Those fish will not mesh, but are taken by the ordinary method of hooks and line fishing. These midsummer fish are much fatter than the spring run. The third run of mackerel, called the 'fall run,' can be counted on to make their appearance about last of October or first November. This is the most important run of mackerel visiting our waters. These fish are on their way south from North Bay, and are the fattest and largest mackerel taken on our coast. They are caught exclusively in nets, excepting those taken by two or three seines owned by local fishermen in Richmond County, and the four fish traps above mentioned.

(2) The method of curing is practically the same as has been practised by fishermen in this district for the last fifty years. The fish are first split open down the back; then they are 'rimmed,' placed in a large tub half filled with sea-water, and allowed to soak for fifteen or twenty minutes. The fish are then taken out of this water, and scraped clean, and every particle of blood removed. They are then put in clean water, and allowed to soak for half-an-hour. Sometimes a third soaking is given, after which they are taken out and placed in tubs or baskets to allow the water to drain off the fish. A liberal quantity of fine salt and pickle is used, and after ten or twelve days the fish are re-salted and pickled in ordinary soft wood barrels. In the last salting very coarse salt is used. After being barrelled the fish are sold to local traders, and a few purchased by a Boston fish firm carrying on business in Cape Breton.

Of late years the fish have been shipped in coasting or trading schooners to Halifax, there sold or shipped per steamer to the Boston market, as the case may be. The following is the mackerel catch in this district for the past six years:—

1888,	11,249 barrels.
1889,	12,969 „
1890,	11,848 „
1891,	8,128 „
1892,	12,450 „
1893,	12,679 „

The prices of mackerel fluctuate greatly; in fact, in no kind of fish is there such a fluctuation in price as in mackerel. During the past few years the average prices paid the fishermen were as follows:—

Spring mackerel,	$6.00 to $7.50.
Midsummer mackerel,	7.25 to 10.50.
Fall mackerel,	10.50 to 14.25.

A limited quantity of mackerel was shipped fresh in ice by rail to the Boston market last summer by an Arichat dealer, and I hear that a larger quantity is likely to be shipped in this way next season. A considerable

quantity of fall mackerel caught in this district were purchased this season by the owners of the fish freezing establishment at Port Mulgrave, which is situated in Inspector Hockin's district. When the mackerel is found favourable, the fish are shipped by rail fresh in ice.

(3) With the exception of four fish traps and two or three ordinary seines, which take other kinds of fish as well as mackerel, no special means have been taken of late years to develop the industry. One or two firms fitted out vessels for the mackerel fishery some years ago, and lost money in the undertaking.

The firm of Messrs P. Paint & Sons, Port Hawkesbury, had one vessel engaged in this fishing during the past season and did fairly well.

There is no doubt that the mackerel fishery is capable of much greater development in this district, but the individual fisherman is content with the old methods of fishing, even with which he very indifferently prosecutes the industry.

Unless capital and enterprise from outside the fishing districts take hold, I do not see any likelihood of the mackerel, or I might add, any other branch of our fishing industry, being developed anything like that of which it is capable in this favourably situated district.—I have, &c.,

(Signed) A. C. Bertram,
Inspector of Fisheries.

Appendix II. Pictou, 27*th January* 1894.

Sir,—In answer to your circular letter, 28th ultimo, regarding the mackerel fishery in this district, I have the honour to report as follows:—

The average quantity of these fish taken in this district is about 20,000 barrels.

Ninety-four per cent. of these are taken in territorial waters by various methods, and about as follows:—

72	per cent.	by	gill-nets.
20	„	„	drag-seines.
7	„	„	trap-nets.
1	„	„	hand-lines.

17½ per cent. of those taken are preserved in cans.

17½ per cent. are sold fresh in ice, and the remaining 65 per cent. are cured, the process being as follows:—

The mackerel when caught are brought to stage heads, and if in large quantities, are dipped out of the boat with dip-nets (that is a small bag-net, fastened to a hoop having a handle attached and capable of holding about fifty mackerel), and are then placed on stages, a second person with a dip-net placing them on a splitting table, on which stands, first, a 'splitter,' who seizes the fish and splits it through the back, beginning at the head. A capable splitter can split easily sixty large mackerel in a minute. Around the same table stand six or eight persons, women, girls, and boys, who take the fish from the splitter and remove gills and entrails, throwing the fish into the tubs or puncheons filled with clean salt water, where they remain half-an-hour, so that they may be cleansed and the blood removed, which is done by stirring the fish. They are then carried inside and stowed in puncheons, each fish being dipped belly down in salt and laid in the puncheons (back down) in tiers; each and every layer is salted as placed in puncheon, and the fish remain in the salt one week and are then considered fit for market.

I should have said that the puncheons are filled with pickle strong enough to float a fish.

The dealers, when they receive fish from the fishermen, generally re-sort them, repacking them 200 lbs. in a barrel, according to their size. The barrel is then coopered and branded.

In some cases fat mackerel are ploughed, that is, two scars are cut on the flesh side to make them look fat. About 5 per cent. of the fish taken are used fresh in the Provinces, the poorer qualities or about 15 per cent. are shipped to and sold in the West India Islands, while the remainder or 80 per cent. find a market in the United States.

The prices realised for salt mackerel this season have been very low, an average price being $9 per barrel.

No special means can be said to have been taken to develop the industry, but this past season a much larger quantity were canned than previously.—I have, &c.,

(Signed) Robert Hockin, *Inspector.*

Appendix III.

Yarmouth, Nova Scotia,
4th January 1894.

Sir,—In reporting upon the questions asked in circular of 28th December 1893, *re* the mackerel fishery of this district, I beg to report that :—

(1) In Lunenburg, the mode of taking this fish is by drag-seines, by gill-nets, and by traps. In Shelburne, Yarmouth, Queens, and Digby, by traps, gill-nets, and weirs.

In Yarmouth and Shelburne the fish are taken in the spring, *i.e.*, from say 10th May to 15th July; these fish are known as spring mackerel, generally classed as large 3's. In Digby, Lunenburg, and Queens, the mackerel are looked for from 15th July to November, and often are taken in December, but the autumn fish are of a smaller run, and of less value.

(2) The mackerel taken in the Counties of Digby, Yarmouth, and Shelburne are not cured, they being shipped to the United States in ice. The fish taken in Lunenburg and Queens are generally cured in the ordinary way, by being split and pickled in barrels, and sold in local markets, from whence the smaller and inferior are sent to the West Indies and Spanish America, the latter grades finding a local consumption.

The prices realised vary to a marked extent; the spring catch of Yarmouth and Shelburne sold at an average of 7 cents. each; the number required to make a barrel, if split and pickled, would be, say 350. At these figures you will observe that the prices ranged far beyond what could be obtained for the fish if shipped in any other state than fresh.

The smaller and latter run of fish realised say $7.00 per barrel.

(3) I know of no special means (other than already mentioned in paragraph 1), being taken to develop this industry.—I am, &c.,

(Signed) J. R. Kinney,
Inspector of Fisheries.

Appendix IV.

Moncton, *8th January* 1894.

Sir,—Referring to circular of the 28th ultimo, *re* the mackerel fishery, I would beg to say :—

(1) They are caught all along our shores, from the Nova Scotia boundary to Quebec. Usually strike in about the middle of July; some seasons they remain on the coast until last of September; this was the case in 1892; in 1893 they left earlier. Fishing is entirely by hook and line, except what are taken by the two trap-nets of Mr A. J. H. Stewart, fished at Pockshaw and Grand Anse, Gloucester County.

(2) More of these fish each year are being shipped fresh in ice or placed in the freezers for winter shipment. They sell at about 8 cents each at the freezers. A considerable quantity are also caught in small boats along the entire coast by farmers and others. Most of these are either used fresh or salted for local consumption; but vessels even at Miscou and Shippegan last summer buying them salted at about $8 per barrel where caught.

(3) No special means have been taken to develop this industry, as fishermen consider the movements of mackerel more erratic than of any other kinds of fish visiting our shores; they are consequently less inclined to invest money in this fishery.—I am, &c.,

(Signed) ROBERT CHAPMAN, *Inspector.*

Appendix V.

CRUISER 'CURLEW,' SAINT ANDREWS,
NEW BRUNSWICK, 16*th January* 1894.

SIR,—I have the honour to acknowledge receipt of your circular of 28th ultimo, directing that I send you full and reliable information on certain points relating to the mackerel fishery in my district.

In reply to question No. 1, nearly every season, during the months of August and September, mackerel strike into the Bay of Fundy. Some seasons only a few barrels are caught, while in other years thousands are taken.

They are taken by means of seines, gill-nets, and weirs, among the numerous islands in Passamaquoddy Bay and Bay of Fundy.

Question No. 2. Nearly all the catch is exported to the United States, and realizes from $6.00 to $20.00 per barrel, according to the quality; about one-half the catch is cured and the rest is exported fresh.

In curing mackerel, the ordinary method by salting is used, but as their appearance each season is extremely uncertain, no special preparations are made for their curing.

No. 3. No especial means have been taken to develop the mackerel industry in my district.—I have, &c.,

(Signed) JOHN H. PRATT,
Inspector of Fisheries.

Appendix VI.

CHARLOTTETOWN,
PRINCE EDWARD ISLAND,
5*th January* 1894.

SIR,—I have the honour to acknowledge receipt of your circular letter of 28th ultimo, requesting me to obtain as speedily as possible the fullest and most reliable information on the following points relative to the mackerel fishery in this district.

(1) The place where, and the time when, the fishing is carried on, and the modes of fishing employed.

(2) Whether the mackerel are cured, and if so, what is the method used, to what markets are they sent, and what are the prices realized.

(3) If any special means have been taken to develop the industry.

In reply to the first point, I beg to state that the mackerel fishing is prosecuted as an industry on the coasts of this province, commencing at Cape Bear, in Kings County, and following the coast line of said county to East Point, thence along the north shores of Kings, Queens, and Prince Counties to North Point, thence in a southerly direction by West Point to Cape Egmont. The principal fishing localities are Georgetown, Annandale, Souris, East Point, Lakeville, Naufrage, and Saint Peters, in Kings County; Tracadie, Rustico, and New London, in Queens County; Malpeque, Alberton, Tignish, Nail Pond, Miminegnash, West Point, and Egmont Bay, in Prince County.

Fishing commences about the 20th of June at most of the places named, and generally closes about the 1st of October. The modes of fishing employed are, the purse-seine, gill-net, and hook and line, the latter being principally used in the shore fishery. The method of curing is to clean and wash the fish well, afterwards salting down in ash-bound soft wood barrels, covering with pickle. A small quantity is also canned each season.

The fish are sent to the United States markets, chiefly to the ports of Boston and New York. Prices vary, but for the last few years mackerel have realized from $10.00 to $25.00 per barrel of 200 lbs. according to quality.

Fifteen dollars per barrel may be considered a fair average price for the last three years.

No special means have been taken to develop the industry.

Shore fishermen have provided themselves with a fair class of well-equipped boats, and while the fish are on the coast, do all possible to capture them.

A few vessels are also fitted for the fishery at some of the most important stations, but beyond this nothing special has been done to develop the industry.—I have, &c.,

(Signed) A. Lord, *Agent.*

William Smith, Esq.,
Deputy-Minister of Marine
and Fisheries, Ottawa.

APPENDIX Q.

REPORT by Col. Malcolm of Poltalloch, on efforts made to establish an Oyster Fishery in Loch Sween.

Achnamara, Lochgilphead,
2*nd November* 1893.

Sir,—In reply to your inquiry of 31st ult., I beg to say that at present Major Campbell and myself have been rather experimenting to ascertain the best points to work on before embarking much capital in the concern. As soon as the Order was passed, I spent £10 in getting down a well-known Whitstable expert, and spent three or four days with him going over and examining the different parts of the loch. We found traces of old local oysters scattered over various parts, but hardly sufficient in any one place to throw much spat. We also found that all or nearly all of the bottom of the loch was mud too soft to carry oysters, and that only a belt between low-water-mark, spring tides and the grass and mud was fitted for cultivation. He recommended our beginning in the Linnhe Varich, where there were most local oysters adhering to the stones, and also another spot which has since proved unsuccessful. In the Linnhe Varich we first moved all the stones that had living oysters on them down to below low water spring tides, to save them from frost, and in spots where they were adhering to stones too heavy to move, or to rocks below the water-mark, we spread tiles, slates, cultch, and fascines, to try and catch the spat. We cleared the ground of rough stones between low-water springs and ordinary low water, and in this way have gathered a good many young oysters in the last two seasons. In addition, I have purchased and laid down 30,000 oysters from Arcachon, costing, with carriage, some £45. The first lot I laid down we found were too much exposed to the action of the waves, and I had to move them to fresh ground, but now they seem thriving well. We have not attempted to sell any, as we want to collect all we can for breeding. The ground is terribly full of various kinds of star-fish and dog whelks, but we have had a man constantly fishing them. We cannot use the dredge, as the ground is too soft. Major Campbell has nearly completed a pond, in which he hopes the young oysters will be safe, and I am making another in another part of the loch, which I think will do for breeding and rearing. None of the local oysters, except those taken from the cleared ground, would do or market, as, owing to their being fixed on large stones, they are either irremovable or mis-shapen, but they will do for breeding. If, as I hope, we shall find a good many young ones saved this season, we shall go in with more confidence. I employ my yacht's crew, when she is laid up, at the work, and they are learning the business. I moved a good many bushels of mussels into deeper water last year, and they have grown fairly well, but we are very much put about by the irregularity of the tides, which makes it difficult for the men to work steadily. The wind has an extraordinary effect on the tide in this loch, and a south-west gale will hold up the water all day sometimes, and give us higher tides at neaps than ordinary spring tides. We have found the ill effects of this in Linnhe Varich which makes it difficult to regulate the beds. At other times a north or north-east wind will keep the tide out, and many oysters are killed by frost. In making my pond I have been much troubled with the weather, but I intend to have a concrete wall with sluices, so that I can always keep 2 feet water over the beds, and the wall is of

such a height that only an exceptional high spring tide will cover it, and thus prevent the floating weed being washed over, and smothering the oysters. I have entered into this detail to show the Board what we are doing, as a mere statement of expenditure would at present be absolutely misleading. As soon as we find that we are definitely in the right way to make the most of the locality, we shall then put in capital, and, I hope, make a success. Of course, boats, rakes, baskets, wading boots for the men, watching hut, and other items have mounted up to a fair sum.—Yours faithfully,

(Signed) J. W. Malcolm.

The Secretary,
Fishery Board for Scotland,
Edinburgh.

TWELFTH

ANNUAL REPORT

OF THE

FISHERY BOARD FOR SCOTLAND.

Being for the Year 1893.

IN THREE PARTS.

PART I.—GENERAL REPORT.
PART II.—REPORT ON SALMON FISHERIES.
PART III.—SCIENTIFIC INVESTIGATIONS.

PART II.—REPORT ON SALMON FISHERIES.

Presented to both Houses of Parliament in pursuance of Act 45 and 46 Vict. cap. 78.

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1894.

TABLE OF CONTENTS.

	PAGE
Salmon Fishing Season of 1893 below average,	v
Table of Boxes of Scotch Salmon sent to Billingsgate from 1834 to 1892 inclusive,	vi
Table of Boxes of Salmon sent to Billingsgate in each month from 1884 to 1893 inclusive,	vi
Replies to printed Queries regarding the yield of the Salmon Fisheries in 1893,	vii
Boxes of Scotch Salmon forwarded from various stations, ports, &c.,	vii
Assessed values or rentals of Salmon Fisheries,	vii
Rental of Tay Salmon Fishings,	x
Return of Fish caught at Salmon Fishings belonging to Aberdeen Harbour Commissioners,	x
Salmon Disease during 1893,	x
Inspections during 1893,	xiii
Map of Watersheds,	*faces p.* xvii
Table of References, &c.,	xvii

APPENDIX.

Twelfth Annual Report to the Fishery Board for Scotland,* 1–107

* A full Table of Contents will be found prefixed to this Report, page 3.

TWELFTH ANNUAL REPORT.

TO THE RIGHT HONOURABLE

SIR GEORGE O. TREVELYAN, Bart.,

Her Majesty's Secretary for Scotland.

Office of The Fishery Board
for Scotland,
Edinburgh, 1*st May* 1894.

Sir,

In continuation of our Twelfth Annual Report, we have the honour to submit—

PART II.—REPORT ON SALMON FISHERIES.

Salmon Fishing Season of 1893 below average.

The fishing season for 1893, judged by the number of boxes of salmon sent to Billingsgate, was below the average of the previous sixty years. During that period the greatest number of boxes sent in any one year was 42,330 in 1835; the smallest number being 11,593 in 1851. The number of boxes sent in 1893 was 18,903, or more than 20 per cent. below the average of the previous ten years. In the following Table will be found the number of boxes sent to Billingsgate in each year since 1834, each box weighing about 1 cwt.:—

Table of Boxes of Scotch Salmon sent to Billingsgate from 1834 to 1893, inclusive.

Year.	Boxes of Salmon	Year.	Boxes of Salmon.
1834	30,650	1864	22,603
1835	42,330	1865	19,009
1836	24,570	1866	21,725
1837	32,300	1867	23,006
1838	21,400	1868	28,020
1839	16,340	1869	20,474
1840	15,160	1870	20,648
1841	28,500	1871	23,390
1842	39,417	1872	24,404
1843	30,300	1873	30,181
1844	28,178	1874	32,180
1845	31,062	1875	20,375
1846	25,510	1876	34,655
1847	20,112	1877	28,189
1848	22,525	1878	26,465
1849	23,690	1879	13,929
1850	13,940	1880	17,457
1851	11,593	1881	23,905
1852	13,044	1882	22,968
1853	19,485	1883	35,506
1854	23,194	1884	27,219
1855	18,197	1885	30,362
1856	15,438	1886	23,407
1857	18,654	1887	26,907
1858	21,564	1888	22,857
1859	15,823	1889	21,101
1860	15,870	1890	18,931
1861	12,337	1891	25,889
1862	22,796	1892	21,919
1863	24,297	1893	18,903

Table of Boxes of Salmon sent to Billingsgate in each month from 1884 to 1893 inclusive.

The Fishmongers' Company have kindly furnished a return showing the number of boxes of Scotch salmon sent to Billingsgate during the months of February to September inclusive, for the years 1884 to 1893 inclusive, together with the average price of salmon sold at that market during those months in 1893. The statement regarding the price of salmon was made up from the daily reports of the Company's fishmeters. From the return furnished by the Fishmongers' Company, the following Table has been compiled, showing the number of boxes of Scotch salmon sent to Billingsgate, from February to September inclusive, during the years 1884 to 1893 inclusive, the average number despatched during each of these months, and the average monthly price per lb. obtained during 1893:—

Month.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	Average of 10 years.	Average Monthly Price p. lb. during 1893.
												s. *d.*
February, .	1,335	879	841	717	535	691	612	934	1,078	557	*818*	1 7
March, .	1,402	1,116	1,008	797	899	1,006	902	1,116	1,688	773	*1,071*	1 9
April, . .	1,973	1,886	1,744	1,456	1,096	1,152	952	1,403	1,657	845	*1,416*	1 8
May, . .	3,162	2,257	2,485	2,432	2,603	1,859	1,844	2,591	2,125	1,997	*2,335*	1 5
June, . .	3,821	3,863	2,896	3,531	3,953	3,827	3,127	4,140	2,438	3,802	*3,540*	1 1
July, . .	8,765	10,582	8,045	9,544	7,943	7,414	7,148	8,007	6,259	5,786	*7,949*	0 11
August, .	6,070	9,151	5,777	7,794	5,474	4,826	4,035	7,028	6,064	4,722	*6,094*	1 1
September,	691	628	611	636	356	326	311	670	610	421	*526*	1 3
Total, .	27,219	30,362	23,407	26,907	22,859	21,101	18,931	25,889	21,919	18,903	*23,749*	

This Table shows that June was the only month in 1893 in which the number of boxes of salmon sent to Billingsgate reached the average of the last ten years.

Replies to printed queries regarding the yield of the Salmon Fisheries in 1893.

The replies which have been received to the usual circular of printed queries, issued at the close of the salmon fishing season, indicate that the fishing season of 1893 was, as a rule, below the average. These queries are sent to the clerks of District Boards, or, where no Boards exist, to persons interested in the salmon fishings, with a view of ascertaining, as far as possible, the state of the fisheries. The answers which have been received are given in Note I. of the Appendices to this report. From fifteen of these replies it seems that the take of fish during the season of 1893 was below the average, from five that it was about the average, while only one reports that it was above the average.

In the following districts the take of fish is reported as having been "below the average," or even, in cases marked *, "considerably below the average," or as having "greatly decreased," viz. :—

Tay.	The rivers of the West Coast of Sutherland.
Dee.	Lochy.
Don.	Girvan.
Ugie.	Cree.
Nairn.	Dee (Kirkcudbright).
*Conon.	Nith.
*The rivers of the East Coast of Sutherland.	Annan.

It is reported from the district of the river South Esk that the take of fish was generally below the average in numbers, but about the same in weight or size ; and, from the Forss, that it was about the average in tidal waters, but below the average in fresh waters.

Of the remaining districts the following report an average take of fish, viz. :—Ythan, Deveron, Findhorn, and Kyle of Sutherland. The only districts from which it is reported that the take of fish was above the average are those of the rivers of the North Coast of Sutherland.

Boxes of Scotch Salmon forwarded from various stations, ports, &c.

The railway companies and steamship owners have again kindly furnished a statement showing the number of boxes of salmon forwarded by them during 1893, from the various stations, ports, &c. It is, however, desirable to make further inquiries regarding these returns before publishing them.

Assessed value or rentals of Salmon Fisheries.

With a view to obtaining fuller information with regard to the state of the fisheries, a circular was addressed to the county and burgh assessors of Scotland, asking them to be so good as to furnish a return showing the rental where let, and the assessed value where *not* let, of each salmon fishing in the different counties or burghs for the four years 1889 to 1892 inclusive, distinguishing between those inside the estuary lines and those outside the estuary lines. This information was asked from those assessors who were also surveyors of taxes, after communicating with the Comptroller of Inland Revenue for Scotland,—as, in many cases, the fresh-water fishings are let with the shootings and returned to the assessors as shootings; the assessors were requested in such cases to communicate with the individual proprietors

and ascertain what proportion was referable to fishings and what to shootings.

We are informed by the Comptroller of Inland Revenue for Scotland that the basis of value of unlet fishings is necessarily arrived at by estimate from the best sources of information obtainable by the assessors. The mode of doing so is ruled by section 6 of the Valuation Act of 1854 (17 & 18 Vict. cap. 91), as regards all 'Lands and Heritages;' and by the interpretation clause of the same Act (section 42), the expression 'lands 'and heritages' extends to and includes 'fishings.' The amount of the letting value of similar fishings in the same neighbourhood, or of rent formerly received for fishings, is usually taken as the best basis of estimate.

In the following Table these returns are divided under five heads, viz. :—Tweed basin, South-Eastern Division, North-Eastern Division, Western Division, South-Western Division. The Tweed basin includes the counties of Berwick, Roxburgh, Selkirk, and Peebles; the South-Eastern Division, the counties of Haddington, Midlothian, Linlithgow, Fife, Stirling, Clackmannan, Perth, Forfar, Kincardine, and Aberdeen; the North-Eastern Division, the counties of Banff, Elgin, Nairn, Inverness (east coast), Ross (east coast), Sutherland (east and north coasts), Caithness, and the Orkney and Shetland Islands; the Western Division, the counties of Sutherland (west coast), Ross and Cromarty (west coast and islands), Inverness (west coast and islands), Argyll, Dumbarton, and Bute; South-Western Division, the counties of Renfrew, Ayr, Wigtown, Kirkcudbright, and Dumfries. The returns for the counties omitted from the above list were *nil.* In the same Table will be found the area of the catchment basins of rivers draining over 20 square miles, together with the extent of seaboard. In order to show graphically the main features of the fresh waters of Scotland, a Map is appended to this report showing the catchment basins of the rivers, together with a Table of reference giving the names of rivers and tributaries, the length of rivers in miles, the areas of catchment basins in square miles, together with the altitude of the highest ground near the source. We are indebted to the Director-General of Ordnance Surveys for permission to reproduce the Map and the Table of reference. In measuring the seaboard, all bays, firths, and lochs which are less than 10 miles wide were omitted, as well as all islands.

The counties situated in the Tweed basin are regulated by the Tweed Salmon Fishery Acts, and are specially exempted from the jurisdiction of the Fishery Board by the Fishery Board (Scotland) Act, 1882 (45 & 46 Vict. cap. 78, sec. 7). If these counties are excluded it will be seen that the rentals or assessed values of the salmon fisheries regulated by the general Salmon Fishery Acts of Scotland amounted in 1890 to £98,770, 0s. 11d., in 1891 to £99,167, 8s. 3d., and in 1892 to £103,688, 12s. 9d. Of these sums, the value attaching to the fisheries inside the estuary lines in 1890 was £65,232, 7s. 6d., and that attaching to those outside the estuary lines, £33,537, 13s. 5d.; in 1891 those inside the estuary lines were valued at £65,828, 18s. 8d., and those outside at £33,338, 9s. 7d.; and in 1892, £69,238, 14s. 8d. represented the value of those inside the estuary lines, and £34,449, 18s. 1d. the value of those outside. It will be seen, therefore, that the assessed value of the fisheries

Division.	Inside the Estuary Lines.				Outside the Estuary Lines.				Total.				Area of catchment basins in square miles.	Length in miles of seaboard.	Remarks.
	1889.	1890.	1891.	1892.	1889.	1890.	1891.	1892.	1889.	1890.	1891.	1892.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.			
Tweed Basin, . .	6,284 10 0	6,484 2 6	6,543 10 0	6,523 10 0	775 0 0	790 0 0	790 0 0	790 0 0	7,059 10 0	7,274 2 6	7,333 10 0	7,313 10 0			The Assessor for the county of Banff says he cannot give the information for 1889, as the books, papers, &c., are not now in his possession. The value of northern and eastern salmon fisheries of Sutherland are distinguished by the Assessor from western salmon fisheries only for 1892; a corresponding deduction has been made for the other years. No return is made for the county of Argyll for the year 1889.
South - Eastern Division, . . .	30,693 12 6	30,269 19 10	30,159 18 8	33,279 8 8	17,403 11 10	16,950 15 11	16,975 12 1	17,984 0 7	48,097 3 6	47,220 12 9	47,135 10 9	51,263 8 10	6543	150	
North - Eastern Division, . . .	...	21,221 4 0	21,872 4 0	22,064 4 0	...	11,649 17 0	11,493 7 0	11,458 7 0	...	32,871 1 0	33,365 11 0	33,522 11 0	6277	280	
Western Division,	...	8,086 11 8	8,203 15 0	8,303 1 5	...	3,458 2 6	3,383 2 6	3,493 2 6	...	11,544 14 2	11,586 17 6	11,796 3 11	3158	350	
South - Western Division, . . .	5,620 15 0	5,654 15 0	5,593 1 0	5,592 1 0	1,418 18 0	1,478 18 0	1,486 8 0	1,514 8 0	7,039 13 0	7,133 13 0	7,079 9 0	7,106 9 0	2777	200	
	...	71,716 10 0	72,372 8 8	75,762 4 8	...	34,327 13 5	34,128 9 7	35,239 18 1	...	106,044 3 5	106,500 18 3	111,002 2 9			

inside the estuary lines is a little more than double that of those outside.

The following is the rental of the Tay Fishings since 1828 :—

Rental of Tay Salmon Fishings.

Year.	Rental.	Year.	Rental.
1828	£14,574 10 0	1861	£14,009 15 7
1829	14,529 10 0	1862	14,080 12 0
1830	13,747 8 0	1863	14,232 16 6
1831	13,874 0 0	1864	16,742 5 2
1832	11,629 0 0	1865	17,618 0 7
1833	11,577 0 0	1866	17,465 3 4
1834	10,907 10 0	1867	16,852 18 4
1835	10,856 10 0	1868	16,965 15 10
1836	10,211 10 0	1869	17,444 15 0
1837	10,150 6 0	1870	17,044 8 4
1838	10,285 0 0	1871	16,382 8 4
1839	10,498 0 0	1872	15,162 15 0
1840	11,058 0 0	1873	17,519 14 0
1841	10,846 5 0	1874	18,941 13 8
1842	10,235 15 0	1875	21,634 4 4
1843	10,512 5 0	1876	19,930 18 4
1844	10,386 10 0	1877	21,126 14 0
1845	10,751 15 0	1878	21,187 1 0
1846	10,099 15 0	1879	21,697 14 0
1847	11,421 10 0	1880	22,518 8 7
1848	12,057 10 0	1881	19,579 11 5
1849	10,729 16 0	1882	19,221 11 7
1850	9,491 11 0	1883	17,773 3 0
1851	9,530 0 0	1884	19,655 14 5
1852	7,973 5 0	1885	20,417 0 2
1853	8,715 17 6	1886	22,542 2 8
1854	9,269 6 5	1887	22,143 16 7
1855	9,977 13 5	1888	19,655 0 0
1856	10,199 10 4	1889	17,731 2 0
1857	10,772 0 5	1890	17,819 10 0
1858	11,487 2 5	1891	17,237 6 8
1859	11,884 14 0	1892	19,018 0 0
1860	13,827 10 7	1893	21,762 14 3

It will be observed, from the above statement, that the rental for 1893 was higher than in any year since 1887. It is, however, stated that it was a very bad fishing season. With regard to this district, it is satisfactory to observe that arrangements have been made for taking off the nets above the Linn of Campsie. The improvement which has taken place in the fishings of other districts where the fresh-water nets have been suppressed leads us to believe that such a policy will be found beneficial to all interests.

Return of Fish caught at Salmon Fishings belonging to Aberdeen Harbour Commissioners.

The Aberdeen Harbour Commissioners have kindly furnished a statement of the number and weight of fish caught at their salmon fishings since 1872. This return shows that the falling-off in these fisheries last year was specially due to the small number of grilse which were caught. From information which has been received by the Inspector of Salmon Fisheries from other sources, it appears that the failure of the grilse season was general in many parts of Scotland.

Salmon disease during 1893.

Salmon disease appears in some rivers to have been more prevalent during 1893 than in the previous year, in others less so. From the Tay District it is reported that it is decreasing; from the South Esk, that it only showed itself to a small extent; from the Dee, that none had been

STATEMENT OF NUMBER AND WEIGHT OF FISH CAUGHT AT SALMON FISHINGS BELONGING TO THE ABERDEEN HARBOUR COMMISSIONERS.

Season.	Salmon.				Grilse.				Sea-Trout.				Total.			
	No.	Weight in lbs.	Total Weight for each period of 7 Years.	* Percentage.	No.	Weight in lbs.	Total Weight for eachperiod of 7 Years.	* Percentage.	No.	Weight in lbs.	Total Weight for eachperiod of 7 Years.	* Percentage.	No.	Weight in lbs.	Total Weight for each period of 7 Years.	* Percentage.
1872	3,981	59,303	.	.	5,923	27,338	.	.	2,512	5,041	.	.	12,416	91,682	.	.
1873	4,200	48,895	.	.	7,239	34,598	.	.	2,518	4,755	.	.	13,957	88,248	.	.
1874	8,100	88,398	.	.	6,187	27,219	.	.	1,671	3,307	.	.	15,958	118,924	.	.
1875	5,961	63,987	.	.	4,714	20,501	.	.	1,163	1,922	.	.	11,838	86,410	.	.
1876	2,873	33,788	.	.	9,184	39,297	.	.	2,710	5,058	.	.	14,767	78,143	.	.
1877	4,811	55,086	.	.	7,737	37,556	.	.	1,320	2,540	.	.	13,868	95,182	.	.
1878	8,918	116,308	465,765	.	3,350	14,446	200,955	.	3,524	6,553	29,176	.	15,792	137,307	695,896	.
1879	1,897	22,964	.	.	7,284	31,141	.	.	1,606	2,785	.	.	10,787	56,890	.	.
1880	4,178	43,587	.	.	5,410	23,720	.	.	2,160	4,123	.	.	11,748	71,430	.	.
1881	4,873	47,191	.	.	11,400	49,349	.	.	3,518	6,627	.	.	19,791	103,167	.	.
1882	6,530	62,717	.	.	7,415	32,413	.	.	2,815	5,644	.	.	16,760	100,774	.	.
1883	6,886	70,384	.	.	13,852	70,555	.	.	4,330	7,969	.	.	25,068	148,908	.	.
1884	5,424	64,866	.	.	6,129	27,817	.	.	3,164	5,646	.	.	14,717	98,329	.	.
1885	4,597	53,989	365,698	78·5	15,129	73,958	308,953	153·7	5,424	9,529	42,323	145·1	25,150	137,476	716,974	103
1886	6,370	68,536	.	.	9,583	39,502	.	.	2,321	4,218	.	.	18,274	112,256	.	.
1887	5,052	55,535	.	.	14,847	60,644	.	.	3,341	5,498	.	.	23,240	121,677	.	.
1888	7,843	83,292	.	.	12,905	58,653	.	.	2,235	3,825	.	.	22,983	145,770	.	.
1889	5,623	60,573	.	.	9,336	38,379	.	.	1,282	2,199	.	.	16,241	101,151	.	.
1890	7,085	66,114	.	.	9,220	43,140	.	.	4,570	8,717	.	.	20,875	117,971	.	.
1891	9,477	107,566	.	.	11,775	58,318	.	.	2,702	4,531	.	.	23,954	170,415	.	.
1892	8,594	88,932	530,548	145·1	11,329	48,620	347,256	112·4	1,329	2,115	31,103	73·5	21,252	139,667	908,907	126·8
1893	6,795	71,185	.	.	5,068	18,131	.	.	3,513	5,294	.	.	15,376	94,610	.	.

The weight for the first septennial period is taken at 100, and for the later periods as proportional parts of the first.

seen since January; from the Don, that 300 diseased fish were taken out of the river between the 31st October 1892 and January 1893, whereas in the previous year about 100 were reported; from the Ythan, that the diseased males numbered 157 and the females 29; from the Ugie, that 92 were reported as against 212 in the previous year. In the Deveron the disease was considerably worse than in 1892; while in the Spey it is reported that the usual amount of fungoid disease was observable among late spawning fish. Leaving the Spey, and following the coast round the north and west of Scotland, no disease is reported, except to a slight extent on the Helmsdale, until coming to the river Dee, in Kirkcudbrightshire, where it is said to have shown itself to a small extent. The same remark applies to the Nith. But in the Annan, on the other hand, the total number of diseased fish taken out of the river is said to have been 669, whereas only 441 were reported in the previous year.

By the direction of the Board Mr Archer visited the district of the river Deveron on the 10th and 11th May for the purpose of inquiring into the outbreak of salmon disease in that river. From the evidence which was given before him it appeared that 1640 diseased fish were taken out of the river in a dead or dying condition from December to May, inclusive. These fish were chiefly found in the waters below the cruive dyke, about 2 miles from the mouth of the river. It was further stated that the disease was much aggravated by larger numbers of fish than usual being collected below this dyke, owing to the prevailing low level of the river. Although it does not seem, from the evidence given at previous inquiries, that the overcrowding of fish is an indispensable condition to the prevalence of salmon disease, yet it can scarcely be doubted that where the disease already exists the infection must be more readily transmitted from one fish to another when the free passage of fish is obstructed by cruive dykes or mill dams, and large numbers are crowded together in one pool. Mr Archer reported that on the Deveron the ordinary obstruction offered by a cruive dyke was still further increased by the cruives not being in accordance with the bye-law (Schedule F., 31 & 32 Vict. cap. 123) which regulates their construction.

From an analysis of the records of diseased fish—salmon, grilse, and sea-trout—taken out of the river Tweed during thirteen years, from 1879 to 1892, which was given in Note III. of the Appendices to last year's Report, it appeared that in the earlier months of the epidemic males succumbed in greater numbers than females. The number of fish dealt with was so great, and there was so little variation to this rule, whether the proportion was taken over the whole period or over each year separately, that it appeared to indicate that this feature was not a mere matter of chance, but due to a definite sequence of events. It will be observed from the monthly returns of the diseased fish taken out of the Deveron and Ugie (the only districts from which monthly returns are made) that the same feature is noticeable on those rivers. It should, however, be added that the diseased fish taken from the Ugie are too few to render the records from that river of much value. Taking into consideration the regularity with which this feature occurred, it seemed desirable to carry out investigations in order to determine to what causes

this might be due. The funds, however, at the disposal of the Board have not at present admitted of such investigations being made on a large scale. A beginning, however, is being attempted, under the direction of the Board, by Mr R. H. Grey, at Berwick-on-Tweed, with the permission of the Berwick Salmon Fishing Company.

Inspections during 1893.

Besides the inquiry into the outbreak of salmon disease on the river Deveron, Mr Archer, by the direction of the Board, visited the district of the river Morar for the purpose of ascertaining whether certain bag-nets were being used illegally, as alleged; he afterwards proceeded to Perth and Coupar-Angus, regarding the petition from the Tay District Board praying for an alteration of the close time for rod-fishing in the rivers Isla and Ericht, tributaries of the Tay. His reports on these matters will be found on pp. 47 and 49. During the summer he visited the salmon fisheries on the west coast from the northern end of the Island of Mull to the Clyde. In his report to the Board, immediately following this report, he draws attention to the unsatisfactory state of matters prevailing on that coast, for which no remedy has hitherto been provided. He also points out that, notwithstanding the low value of these fisheries compared with those of a similar extent on the East Coast, yet the statement of the assessed values of these fisheries, furnished by the county and burgh assessors, shows that if *all* were assessed, even at a rate below that at which some local Boards assess the fisheries in their districts, the amount realised would provide for the payment of a staff of watchers and the maintenance of steam launches to see that the Acts were enforced along the whole of this part of the coast, besides leaving a considerable margin towards the cost of protecting the fresh waters. Just after the close of the year, Mr Archer visited the district of the river Doon for the purpose of inquiring into the destruction of fish in that river during December. The result of his inquiry will be found at page 60.

The improvements in the existing Salmon Fishery Acts, which would probably combine the suffrages of the upper and lower proprietors, were summarised in our Eleventh Annual Report.

Recommendations for future legislation.

We desire to point out that the Acts have not proved successful in providing for the free passage of fish from the sea to the head waters of the rivers. From the evidence laid before us we consider that to provide a free passage to the fresh waters for a proportion of every run of fish and to protect them when there, form the kernel of the whole salmon fishery question; and that if these provisions were secured they would lead (1) to the fisheries yielding more fish, (2) to the employment of a greater number of persons, (3) to an increase in the assessed values or rentals of the existing fisheries, both in the upper and lower waters, and (4) to the places in which fishing can be exercised becoming more numerous. The evidence on this subject is entered into at greater length in Mr Archer's report to the Board immediately following this Report, and in his report on 'Crown Unchartered Inland Waters,' which will be found on page 51 of the Appendices to this Report. In order to carry out this principle we desire to recommend that in any future Salmon Fishery legislation it be provided that a line shall be drawn upon a map of Scotland across each salmon fishery district to mark the

division between the upper and lower waters, and that the commercial fisheries shall be confined to the lower waters, while the upper waters shall be reserved as a sanctuary for the fish, where all fishing shall be prohibited except fair and legitimate angling for recreative purposes only.

Complaints continue to be made regarding the illicit traffic in salmon during the annual close season. We are strongly of the opinion that the law respecting the sale of salmon during the annual close time should be amended. What is chiefly required is :—

1*st.* To prohibit the buying of, selling of, exposing for sale of, or having in possession for sale, salmon caught by rod and line during the annual close time for net fishing.

2*nd.* To throw the burden of proof on the vendor.

3*rd.* To obtain in Scotland powers similar to those conferred by the English Salmon and Freshwater Act of 1892 (55 & 56 Vict. c. 50).

An advance has been made towards obtaining statistics by procuring a statement of the assessed values. Those obtained are, however, still insufficient to show the effect of the Acts on the productiveness of the fisheries. For it must be borne in mind that the assessed values of the fisheries can only indicate their condition so long as they continue to be assessed on their present basis, and further that they afford no indication of the conditions which have led to such a rise or fall. We are of the opinion that the collection of full and accurate statistical information is probably one of the most valuable services the Government can render the fisheries. For statistics are one of the principal factors in the study of the question which ought to form the basis of all Salmon Fishery legislation, viz.:—at what point the number of fish captured exceed the number reproduced. Indeed, they seem to be not only one of the principal factors in the study of this problem—a problem which has been the subject of legislation, attempted legislation, Royal Commissions, and endless controversies, during the last six hundred years —but the ground-work to the attainment of all accurate knowledge respecting the fisheries which alone will enable legislation to be based on ascertained conditions. So long as the present want of wide statistical knowledge continues, the result of all efforts to develop the productiveness of the salmon fisheries must necessarily remain uncertain, and such uncertainty gives rise to widely conflicting opinions of what is for their benefit. Experience, however, shows that such opinions change from time to time, or differ in different localities. At one period, or in one district, the tendency is towards more restrictive regulations, at others, in the opposite direction. All such differences of opinion may be turned to good account by a careful system of recording the various changes which take place, together with the yield of the fisheries. If this were done it can scarcely be doubted that such a policy would ultimately result in legislation being based on ascertained facts, to the benefit of all interests. The value of statistics has for some time been recognised in the case of the sea fisheries; and has recently been strongly advocated by a Select Committee of the House of Commons appointed to consider the expediency of adopting measures for the preservation and improvement of these fisheries. This Committee in their report remark that the inquiry made

by them was almost the first in which the more important complaints were founded, not merely on the statements and ideas of rival fishermen, but upon facts and statistics. The necessity for collecting similar information with regard to the salmon fisheries is greater even than in the case of the sea fisheries from the fact that the migratory instincts of salmon offer greater opportunities for human interference than obtain in the case of fish that remain in the open sea. We desire, therefore, to recommend that the Fishery Board should be vested with powers for the collection of such statistical information as will enable them to determine the result of the measures taken for the improvement of the fisheries.

In conclusion, we desire to record our obligation to the Comptroller of Inland Revenue for Scotland for his kind assistance in procuring the returns relating to the assessed value of the salmon fishings from those surveyors of taxes who are also county assessors, and to thank these officers, as well as those county assessors who are not identified with the Inland Revenue Department, for tabulating and furnishing these returns. We are also indebted to the Comptroller for information as to the basis on which these assessments are made.

We have the honour to be,

Sir,

Your most obedient Servants,

P. ESSLEMONT, *Chairman.*
JOHN GUTHRIE SMITH, *Deputy-Chairman.*
GEORGE H. M. THOMS.
D. M'KECHNIE.
W. C. M'INTOSH.
WILLIAM BOYD.
J. RITCHIE WELCH.

The following members dissenting, viz.:—

JAMES JOHNSTON.
W. ANDERSON SMITH.

ORDNANCE SURVEY OF SCOTLAND

RIVERS AND THEIR CATCHMENT BASINS.

Scale_Ten Statute Miles to One Inch

10 8 6 4 2 0 10 20 30 40 50 Miles

W. Lon. 8°20′ 10′ 8° 50′ 40′ 30′ 20′ 10′ 7° 50′ 40′ 30′ 20′ 10′ 6° 50′ 40′ 30′ 20′ 10′ 5° 50′ 40′

Lat. 59°30′ 20′ 10′ 59° 50′ 40′ 30′ 20′ 10′ 58° 50′ 40′

Rona or Ronaidh

Sula Sgeir

BUTT OF LEWIS

Cellar Head

TOLSTA HEAD

TIUMPAN HEAD

CHICKEN HEAD

KEBOCK HEAD

Broad Bay

Stornoway

GALLON HEAD

Flannel Isles

WESTERN ISLES

LEWIS

HARRIS

Scarp

HUSINISH POINT

Langabhat L.

West L. Tarbert

Taransay

Scalpay

Sound of Shiant

Shiant Islands

THE MINCH

TOE HEAD

Pabbay

Berneray

SOUND OF HARRIS

Renish Point

Griminish Pt

North Uist

Weaver's Pt

SOUND OF MONACH

Monach Islands

Ronay

Benbecula

Wiay

Ardivachar Pt

Hoe Pt

Rudha Hallagro

Rudha Ardvula

South Uist

Rudha na Horday

SEA OF THE HEBRIDES

THE LITTLE MINCH

RUDHA HUNISH

VATERNISH POINT

LOCH SNIZORT

DUNVEGAN HEAD

L. Dunvegan

L. Snizort

Bracadale

IDRIGILL POINT

SOUND OF RAASAY

Island of Raasay

Island of Rona

INNER SOUND

SKYE

Scalpay

Rudh' an Dunain

Soay

L. Scavaig

Tarskavaig Pt

Point of Sleat

L. Eishort

L. Ainort

L. Torridon

L. Damh

L. Kishorn

L. Carron

L. Gairloch

RED POINT

LOCH MAREE

Fionn L.

L. na Sheallag

L. Ewe

L. a' Bhraoin

Lochan Fada

L. Fannich

L. Luichart

L. a' Chroisg

R. Meig

R. Orrin

R. Carron

R. Blaw

L. Monar

R. Farrar

R. Glass

R. Cannich

L. Mullardoch

R. Enrick

R. Affric

R. Cruo

R. Sligachan

L. Clunie

R. Moriston

Loch Ness

L. Beag

L. Lochy

Caol Loch Aline

Loch Sunart

Loch Shiel

Loch Arkaig

Loch Eil

Loch Linnhe

Loch Leven

Loch Etive

Loch Awe

Loch Fyne

Loch Long

Loch Lomond

Loch Katrine

Loch Voil

Loch Earn

Loch Tay

Loch Rannoch

Loch Tummel

Loch Garry

Loch Quoich

Loch Hourn

Loch Nevis

Loch Morar

Loch Shiel

Loch Eilt

Loch Doilet

Loch Moidart

Loch Ailort

Loch Eynort

Loch Bracadale

Loch Harport

Loch Dunvegan

Loch Snizort

Loch Greshornish

Loch Portree

Loch Staffin

Loch Leathan

Loch Erisort

Loch Seaforth

Loch Roag

Loch Shell

Loch Resort

Loch Tarbert

Loch Finlaggan

Loch Indaal

Loch Gruinart

Loch Ryan

Loch Doon

Loch Trool

Loch Dee

Loch Ken

Loch Skerrow

Loch Urr

Loch Fleet

Loch Brora

Loch Naver

Loch Shin

Loch Assynt

Loch Stack

Loch More

Loch Eriboll

Loch Hope

Loch Inchard

Loch Laxford

Loch Glendhu

Loch Eye

Loch Migdale

Loch Buidhe

Loch Watten

Loch Calder

Loch Heilen

Loch Rangag

Loch Scarmclate

Loch Olabhat

Loch Druidibeg

Loch Bee

Loch Hallan

Loch Obisary

Loch Aline

Loch Sween

Loch Crinan

Loch Gilp

Loch Striven

Loch Ruel

Loch Goil

Loch Eck

Loch Riddon

Loch Scridain

Loch Don

Loch Leven

Loch Rannoch

Loch Ericht

Loch Laggan

Loch Treig

Loch Lochy

Loch Oich

Loch Garry

Loch Quoich

Loch Hourn

Loch Nevis

Loch Morar

Loch Shiel

Loch Eilt

Loch Doilet

Loch Moidart

Loch Ailort

Loch Eynort

Loch Bracadale

Loch Harport

Loch Dunvegan

Loch Snizort

Loch Greshornish

Loch Portree

Loch Staffin

Loch Leathan

Loch Erisort

Loch Seaforth

Loch Roag

Loch Shell

Loch Resort

Loch Tarbert

Loch Finlaggan

Loch Indaal

Loch Gruinart

Loch Ryan

Loch Doon

Loch Trool

Loch Dee

Loch Ken

Loch Skerrow

Loch Urr

Loch Fleet

Loch Brora

Loch Naver

Loch Shin

Loch Assynt

Loch Stack

Loch More

Loch Eriboll

Loch Hope

Loch Inchard

Loch Laxford

Loch Glendhu

Loch Eye

Loch Migdale

Loch Buidhe

Loch Watten

Loch Calder

Loch Heilen

Loch Rangag

Loch Scarmclate

Loch Olabhat

Loch Druidibeg

Loch Bee

Loch Hallan

Loch Obisary

Loch Aline

Loch Sween

Loch Crinan

Loch Gilp

Loch Striven

Loch Ruel

Loch Goil

Loch Eck

Loch Riddon

Loch Scridain

Loch Don

Loch Leven

Loch Rannoch

Loch Ericht

Loch Laggan

Loch Treig

Loch Lochy

Loch Oich

CAPE WRATH

Handa Island

Point of Stoer

RHU COIGACH

Enard Bay

Summer Isles

Greenstone Pt

Cailleach Hd

RUDH' RÉ

Gruinard Bay

L. Ewe

L. Broom

Little L. Broom

Strathbeg Bay

L. Assynt

L. Stack

L. More

L. Eriboll

L. Hope

L. Urigill

Cam L.

R. Oykell

R. Cassley

Kyle of Sutherland

Dornoch Firth

Moray Firth

Beauly Firth

Inverness Firth

Loch Shin

Loch Fleet

Loch Brora

Loch Naver

Loch Migdale

Loch Buidhe

Loch Watten

Loch Calder

Loch Heilen

Loch Rangag

Loch Scarmclate

Loch Olabhat

Loch Druidibeg

Loch Bee

Loch Hallan

Loch Obisary

Loch Aline

Loch Sween

Loch Crinan

Loch Gilp

Loch Striven

Loch Ruel

Loch Goil

Loch Eck

Loch Riddon

Loch Scridain

Loch Don

Loch Leven

Loch Rannoch

Loch Ericht

Loch Laggan

Loch Treig

Loch Lochy

Loch Oich

W Lon. 8°40′ 30′

Lat. 57°50′ Lat. 57°50′

St Kilda

W. Lon. 8°40′ 30′

0′ 20′ 10′ 4° 50′ 40′ 30′ 20′ 10′ 3° 50′ 40′ 30′ 20′ 10′ 2° 50′ 40′ 30′ 20′ 10′ 1° W. Lon. 0°50′

Fair Isle

Lat. 59°30′

20′

10′

59°

ORKNEY ISLANDS

Papa Westray

North Ronaldsay

Westray

THE NORTH SOUND

Sanday

WESTRAY FIRTH

SANDAY SOUND

Eday

Rousay

Brough Head

STRONSAY

Stronsay

FIRTH

Shapinsay

MAINLAND

Kirkwall

Stromness

Mull Head

Old Man of Hoy

SCAPA FLOW

Burray

Hoy

South Ronaldsay

PENTLAND FIRTH

DUNNET HEAD

DUNCANSBAY HEAD

Dunnet Bay

STRATHY POINT

Thurso

Forss Water

L. Calder

Sinclairs Bay

NOSS HEAD

L. Watten

Wick Water

Wick

R. Thurso

Strathy Water

Halladale River

R. Borgie

L. Loyal

R. Naver

L. Naver

Sarclet Hd

Halberry Hd

Dunbeath Water

Berriedale Water

R. Helmsdale

Sròn Mhòr

Sron Rudha na Gaoithe

R. Brora

R. Fleet

R. Evelix

R. Oykel

R. Shin

R. Carron

R. Alness

Dornoch Firth

TARBAT NESS

Tain

Nigg Bay

Cromarty

CROMARTY FIRTH

Dingwall

Fortrose

Nairn

Muckle Burn

Burghead Bay

Elgin

Forres

R. Lossie

SPEY BAY

Logie Hd

Portsoy

Troup Hd

Rosehearty

KINNAIRDS HEAD

Fraserburgh

Macduff

Banff

Fochabers

River Isla

Keith

River Deveron

Turriff

L. of Strathbeg

RATTRAY HD

R. Ugie Water

R. Ugie

Peterhead

BEAULY FIRTH

Inverness

R. Ness

River Nairn

River Findhorn

Loch Indorb

L. Duntelchaig

River Dulnan

River Spey

R. Avon

R. Isla

R. Fiddich

Huntly

River Ythan

Old Meldrum

River Ury

Inverurie

River Don

Kintore

L. of Skene

Aberdeen

Girdle Ness

Hackley Hd

MORAY FIRTH

NORTH SEA

W. Lon. 2° 50′ 40′ 30′ 20′ 10′ 1° W. Lon. 0°50′

Lat. 60°50′

Herma Ness

Unst

Yell

Fetlar

YELL SOUND

Esha Ness

Out Skerries

ST. MAGNUS BAY

Muckle Roe

Whalsey

Papa Stour

Dury Voe

South Nesting Bay

Lerwick

Bressay

Scalloway

Foula

West Burra

Helli Ness

Fitful Head

Sumburgh Head

SHETLAND ISLANDS

Lat. 60°

Lat. 59°50′

W. Lon. 2°10′ 2° 50′ 40′ 30′ 20′ 10′ 1° W. Lon. 0°50′

60°

58°

ATLANTIC

OCEAN

IRELAND

NORTH CHANNEL

IRISH SEA

Barra
Vatersay
Sandray
Pabbay
Mingulay
Berneray
Rum
POINT OF SLEAT
SOUND OF RUM
Eigg
Sound of Eigg
Muck
SOUND OF SLEAT
LOCH ARKAIG
LOCH MORAR
SOUND OF ARISAIG
Eilean Shona
LOCH SHIEL
POINT OF ARDNAMURCHAN
L. Eil
R. Lochy
River Spean
L. Treig
Water of Nevis
L. Lochy
River Roy
L. Laggan
L. Oich
R. Garry
Coll
CALIACH PT
Tobermory
Tiree
Hynish Bay
Treshnish Isles
Gometra
L. Tuath
Ulva
SOUND OF MULL
L. na Keal
ISLAND OF MULL
Lismore Id.
Lynn of Lorne
L. Linnhe
R. Creran
R. Etive
L. Laidon
L. Ba
L. Tulla
R. Kinglass
River Orchy
R. Fillan
Rudha na h-Uamha
L. Scridain
Iona
Erraid
L. Buy
Torran Rocks
Oban
R. Awe
LOCH AWE
FIRTH OF LORNE
Isles of the Sea
Scarba
Luing
Colonsay
Oronsay
RUDH'A' MHAIL
SOUND OF ISLAY
L. Indaal
Bowmore
LAGGAN BAY
RHINNS POINT
MULL OF OA
Texa
Gigha Island
Cara Isld
SOUND OF GIGHA
KILBRANNAN SOUND
SOUND OF JURA
KILBERRY HEAD
West Tarbert
Lochgilphead
L. Nell
L. Crinan
R. Add
R. Aray
R. Shira
R. Fyne
R. Fyllach
Inveraray
Inchmarnock
SOUND OF BUTE
Island of Bute
Rothesay
Kyles of Bute
GABROCH HEAD
Largs
Dalry
Ardrossan
Irvine
Irvine Bay
Troon
Prestwick
Ayr
Machrihanish Bay
Campbeltown
MULL OF KINTYRE
Sanda Island
Ailsa Craig
Girvan
Maybole
Water of Girvan
BENNANE HEAD
BALLANTRAE BAY
CORSEWALL POINT
LOCH RYAN
Stranraer
Broadsea Bay
LUCE BAY
MULL OF GALLOWAY
Rathlin Island
LOUGH SWILLY
LOUGH FOYLE
Londonderry
Coleraine
Larne
Carrickfergus
BELFAST LOUGH
Belfast
Donaghadee
STRANGFORD L.
Port Glasgow
Greenock
Johnstone
L. Thom
Helensburgh
Gare Loch
L. Long
R. Leven
Dumbarton
L. Lomond
Duchray Water
R. Forth
R. Teith
R. Allan
R. Blackwater
R. Bladenoch
Whithorn
Isle of Whithorn
Burrow Head
Port William
Glenluce
Newton Stewart
Wigtown
Kirkcudbright
Dundrennan
Auchencairn
Carsethorn
Dalbeattie
Castle Douglas
Gatehouse of Fleet
Creetown
Palnure
Barhill
Minnigaff
Water of Ken
Loch Ken
Dee
Water of Dee
Tongland
Tarff
Ken
Crossmichael
Kirkpatrick Durham
Carsphairn
Dalmellington
Ayr
Maybole
Girvan
Ballantrae
Stranraer
Portpatrick
Drummore
Kirkmaiden
Port Logan
Luce Bay
Sandhead
Glenapp
Lochans
Innermessan
Stoneykirk
Ardwell
Kirkcolm
Corsewall Point
Loch Ryan
Broadsea Bay
Milleur Point
Mull of Galloway
Isle of Whithorn
Burrow Head
Wigtown Bay
Fleet Bay
Kirkcudbright Bay
Solway Firth
Annan
Dumfries
Lochmaben
Moffat
Lockerbie
Ecclefechan
Gretna
Canonbie
Langholm
Eskdalemuir
Ettrick Forest
Selkirk
Hawick
Jedburgh
Kelso
Coldstream
Berwick-upon-Tweed
Tweedmouth
Spittal
Holy Isld
Lamlash
Brodick
Whiting Bay
Kildonan
Pladda
Ailsa Craig
Drippin Hd
Machrihanish
Campbeltown
Sanda Island
MULL OF KINTYRE
Rathlin Island
Larne
Carrickfergus
Belfast
Donaghadee
STRANGFORD L.
BELFAST LOUGH
LOUGH SWILLY
LOUGH FOYLE
Londonderry
Coleraine
Ballycastle
Ballintoy Harbour
Portrush
Portstewart
Castlerock
Downhill
Magilligan Point
Lough Foyle
Inishowen Head
Dunaff Head
Malin Head
Inishtrahull
Tory Island
Fanad Head
Lough Swilly
Rathmullan
Buncrana
Letterkenny
Milford
Carndonagh
Ballyliffin
Inishowen
Lough Foyle
Lough Swilly
Lough Erne
Lough Melvin
Lough Gill
Sligo
Ballyshannon
Donegal
Killybegs
Glencolumbkille
Slieve League
Teelin
Kilcar
Carrick
Ardara
Glenties
Dungloe
Gweedore
Bloody Foreland
Rutland Island
Arranmore
Aranmore
Inishbofin
Inishdooey
Inishkeel
Inishmeane
Inishmore
Inishmurray
Inishfree
Inishfree Bay
Inishkea North
Inishkea South
Inishglora
Inishbiggle
Inishturk
Clare Island
Achill Island
Achill Sound
Achill Head
Blacksod Bay
Belmullet
Broadhaven
Erris Head
Downpatrick Head
Ballycroy
Ballina
Killala
Killala Bay
Sligo Bay
Mullaghmore
Aughris Head
Rosses Point
Drumcliff Bay
Ballysadare Bay
Ballysadare
Collooney
Tobercurry
Dromore West
Easkey
Ballinrobe
Lough Mask
Lough Corrib
Galway
Galway Bay
Aran Islands
Inishmore
Inishmaan
Inishere
Kilronan
Kilkieran Bay
Roundstone
Clifden
Cleggan Bay
Slyne Head
Inishbofin
Inishturk
Clare Island
Clew Bay
Clew Bay Head
Westport
Newport
Mulranny
Achill Island
Achill Sound
Achill Head
Blacksod Bay
Belmullet
Broadhaven
Erris Head
Downpatrick Head
Ballycroy
Ballina
Killala
Killala Bay
Sligo Bay
Mullaghmore
Aughris Head
Rosses Point
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Ballysadare
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Kilronan
Kilkieran Bay
Roundstone
Clifden
Cleggan Bay
Slyne Head
Inishbofin
Inishturk
Clare Island
Clew Bay
Clew Bay Head
Westport
Newport
Mulranny

W. Lon. 7°40′ 30′ 20′ 10′ 7° 50′ 40′ 30′ 20′ 10′ 6° 50′ 40′ 30′ 20′ 10′ 5° 50′ 40′

Lat. 54°30′ 40′ 50′ 56° 10′ 20′ 30′ 40′ 50′ 55° 10′ 20′ 30′ 40′ 50′ 10′ 20′ 30′ 40′ 50′

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NORTH SEA OCEAN

ENGLAND

Director General of Ordnance Surveys

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TABLE OF REFERENCE TO MAP OF RIVERS AND THEIR CATCHMENT BASINS.

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
1	AMHAINN CHEARBHAIG,	5·0	9·2	1000	Loch na Gainmhich to the Sea.
2	AMHAINN NA CLAIGIONNACH,	5·5	12·1	1000	Source near Cnoc na Glaic Tarsuinn to Kyle of Durness.
3	AMHAINN NA BUAIGHEAL DUIBHE,	5·0	9·	1709	Source near Farrmheall to Kyle of Durness.
4	AMHAINN SRATH NA CAILLICH,	4·8	6·6	1522	Source near Meall na Mòine to the Sea.
5	SANDWOOD LOCH, . .	8·2	15·2	1709	Source to the Sea.
6	AMHAINN NA FAS THIRE MOIRE,	3·8	4·5	1165	Source near An Socach to the Sea.
7	ALLT LOCHAN INNIS NA BA BUIDHE,	4·2	3·0	1165	Source near An Socach to Loch Inchard.
8	ACHRIESGILL WATER, .	3·5	9·7	1034	Lochan Tarbhaich Mòr to Loch Inchard.
9	AMHAINN AN RUIGHE CHOINNICH,	8·5	14·2	2548	Source near Meall a' Chuirn to Loch Inchard.
10	AMHAINN GHEISGEILL, .	6·8	11·8	2364	Source near Ben Stack to the Sea.
11	STREAM, ...	6·5	12·2	1543	Source at Ben Dreavie to the Sea.
12	MALDIE BURN, . . .	7·0	9·3	1500	Source to Loch Glendhu.
13	RIVER LAXFORD, . .	14·0	46·5	2010	Source near Meall an Fheur Loch to Loch Laxford.
14	AMHAINN DIONARD, .	13·8	32·2	2548	Loch an Ulabhith to Kyle of Durness.
15	AMHAINN AN T-SRATHA BHIG, ...	7·2	16·3	1250	Loch Dubh to Loch Eireboll.
16	RIVER HOPE, . . .	18·8	82·9	2625	Coire Loch to Loch Eireboll.
17	ALLT NA TRAGHA, . .	3·2	6·0	800	Loch Maol to Loch Eireboll.
18	ALLT SRATH MELNESS, .	6·2	10·2	800	Source to the Sea.
19	ALLT ACH NAM PULAG, .	6·0	6·5	1521	Source to Kyle of Tongue.
20	AMHAINN CEANN LOCHA,	9·8	20·9	2364	Source to Kyle of Tongue.
21	ALLT AN RIAN, . . .	6·0	11·0	2504	Source near Loch an Dithreibh to Kyle of Tongue.
22	ALLTAN DEARG, . .	4·5	4·0	500	Source to the Sea.
23	RIVER BORGIE, . . .	21·2	62·3	1167	Source near Cnoc an Daimh Mòr to the Sea.
24	RIVER NAVER, . . .	34·2	199·4	1470	Loch Coire na Sith to the Sea.
25	CLACHAN BURN, . .	5·5	5·5	605	Source to the Sea.
26	SWORDLY BURN, . .	5·2	4·7	605	Source to the Sea.
27	KIRTOMY BURN, . .	3·2	2·8	723	Loch Gaineimh to the Sea.
28	ARMADALE BURN, . .	6·0	7·3	723	Loch Buidhe Beag to the Sea.
29	STRATHY WATER, . .	16·0	43·2	1110	Source near Creagán Dubha Reidhe Bhig to the Sea.
30	HALLADALE RIVER, .	20·8	107·0	1442	Source at Knockfin Heights to the Sea.
31	SANDSIDE BURN, . .	6·5	9·2	700	Source to the Sea.
32	REAY BURN, . . .	4·5	3·3	700	Source to the Sea.
33	BURN OF ISAULD, . .	7·5	12·0	952	Source near Beinn nam Bad Mhòr to the Sea.
34	FORSS WATER, . . .	26·0	51·3	700	Source to the Sea.
35	RIVER THURSO, . .	40·8	191·9	1442	Source at Knockfin Heights to the Sea.
36	BURN OF RATTAR, . .	4·8	8·2	240	Source near Hill of Slickly to the Sea.
37	BURN OF FRESWICK, .	5·0	9·0	288	Source to the Sea.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
38	WATER OF WESTER,	10·0	38·5	241	Source near Hill of Stroupster to the Sea.
39	WICK WATER,	21·0	110·6	693	Source near Cnoc an Earrannaiche to the Sea.
40	CLYTH BURN,	4·0	6·5	693	Source near Cnoc an Earrannaiche to the Sea.
41	REISGILL BURN,	5·0	3·2	815	Source near Stemster Hill to the Sea.
42	BURN OF FORSE,	3·8	4·0	942	Source to the Sea.
43	BURN OF LATHERON-WHEEL,	4·8	7·3	740	Source near Coire na Beinne to the Sea.
44	DUNBEATH WATER,	13·5	44·2	1040	Loch Braigh na h-Aibhne to the Sea.
45	BERRIEDALE WATER,	19·8	65·2	1442	Source at Knockfin Heights to the Sea.
46	OUSDALE BURN,	3·8	5·6	1153	Source near Cnoc Allt na Beithe to the Sea.
47	RIVER HELMSDALE,	27·5	220·7	1903	Source near Ben Griam Bheag to the Sea.
48	LOTH BURN,	5·5	14·3	1940	Source near Beinn na Meilich to the Sea.
49	KINTRADWELL BURN,	4·0	3·2	1767	Source near Beinn Chòl to the Sea.
50	RIVER BRORA,	29·5	163·8	1516	Glas-loch Mòr to the Sea.
51	GOLSPIE BURN,	5·5	9·8	1326	Source near Meall Odhar to the Sea.
52	CULMAILIE BURN,	4·2	5·0	1464	Source near Beinn Lundie to Loch Fleet.
53	RIVER FLEET,	12·5	73·0	1059	Source near Beinn Dùlaich to Loch Fleet.
54	SKELBO BURN,	5·5	4·8	1000	Loch nan Laogh to Loch Fleet.
55	RIVER EVELIX,	17·8	32·8	1092	Source near Cnoc Tòrr an Leamhainn to Dornoch Firth.
56	SPINNINGDALE BURN,	6·2	12·7	900	Source to Dornoch Firth.
57	KYLE OF SUTHERLAND,	34·0	191·6	3273	Source near Ben More Assynt to Dornoch Firth.
58	RIVER CARRON,	25·8	116·3	3039	Principal Tributaries to Kyle of Sutherland.
59	RIVER CASSLEY,	22·2	73·2	2597	
60	RIVER SHIN,	29·8	225·5	2010	
..	*Loch Shin*,	16·8	..	Wr. 270	Included in Shin Catchment.
..	*River Tirry*,	16·5	..	1500	Feeder to Loch Shin.
		Total,	606·6		
61	AMHAINN A' GHLINNE DHUIBH,	5·2	10·5	2597	Loch Dubh to Loch Glendhu.
62	UNAPOOL BURN,	4·2	5·0	2508	Source near Quinag to Loch Glencoul.
63	AMHAINN GLEANN LEIRG,	4·2	5·8	2508	Source near Quinag to the Sea.
64	OLDANY RIVER,	6·2	8·2	400	Loch Gleannan a' Choit to the Sea.
65	UIDH A MHAORAICH,	5·0	7·0	600	Loch nan Uidhean Beaga to the Sea.
66	RIVER INVER,	16·5	62·6	1500	Loch Awe to Loch Roe.
..	*Loch Assynt*,	6·2	..	Wr. 215	Included in Inver Catchment.
67	AMHAINN NA CÙILEIG,	9·8	14·2	2779	Lochan Fada to Loch Inver.
68	RIVER KIRKAIG,	19·2	56·0	2670	Source to the Sea.
69	RIVER POLLY,	10·0	20·7	2786	Source to Enard Bay.
70	RIVER GARVIE,	9·5	19·7	2523	Source to Enard Bay.
71	RIVER KANAIRD,	10·2	38·0	1500	Clar Lochan to the Sea.
72	ULLAPOOL RIVER,	16·0	31·7	3000	Source near Seana Bhraigh to Loch Broom.
73	RIVER LAEL,	6·0	11·3	3547	Source near Beinn Dearg to Loch Broom.
74	RIVER BROOM,	12·5	55·9	2424	Source near An Groban to Loch Broom.
75	STRATHBEG RIVER,	12·5	33·3	2646	Source near Creag Rainich to Little Loch Broom.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
76	ALLT AIRDEASAIDH, .	4·5	5·5	3474	Source at An Teallach to Little Loch Broom.
77	GRUINARD RIVER, . .	17·8	59·2	3250	Source near Beinn Bheag to Gruinard Bay.
78	INVERIAVANIE RIVER,	7·2	7·7	2802	Source near Beinn a' Chàisgein Mòr to Gruinard Bay.
79	LITTLE GRUINARD RIVER,	13·2	31·5	2750	Gorm Loch Mòr to Gruinard Bay.
80	ALLT BAD AN LUIG, .	6·0	5·8	700	Lochain Cnapach to Gruinard Bay.
81	ALLT BEITHE, . . .	4·8	5·7	692	Loch Mhic Ille Riabhaich to Loch Ewe.
82	RIVER SAND, . . .	5·0	6·0	962	Source near Cnoc Breac to Loch Gairloch.
83	ABHUINN GHLAS, . .	3·8	4·0	1381	Loch na Féithe Mugaich to Loch Gairloch.
84	RIVER KERRY, . . .	7·8	14·5	2869	Source near Baosbheinn to Loch Gairloch.
85	ABHUINN BAD A' CHROTHA,	12·2	21·5	2995	Source near Beinn Dearg to Loch Gairloch.
86	ABHUINN RUADH, . .	4·5	5·0	943	Source near Meall na h-Uamha to the Sea.
87	CRAIG RIVER, . . .	6·2	9·1	3232	Source near Beinn Alligin to Loch Torridon.
88	AMHAINN ALLIGIN, .	3·8	3·7	3232	Source at Beinn Alligin to Upper Loch Torridon.
89	AMHAINN COIRE MHIC NOBUIL,	5·2	10·0	3217	Source near Beinn Eighe to Upper Loch Torridon.
90	RIVER EWE, . . .	26·8	174·0	1500	Source at Càrn Odhar to Loch Ewe.
..	*Loch Maree*, ...	12·5	..	Wr. 32	Included in Ewe Catchment.
91	RIVER TORRIDON, . .	8·0	20·3	3456	Source at Liathach to Upper Loch Torridon.
92	RIVER BALGY, . . .	10·5	21·8	2410	Source at Beinn na h-Eaglaise to Upper Loch Torridon.
93	AMHAINN DUBH, . .	7·0	9·5	1682	Source at An Staonach to Loch Shieldaig.
94	AMHAINN CHUAIG, . .	6·2	5·5	1618	Source at Cròic-bheinn to the Sea.
95	ALLT NA TRÀIGHE, .	4·2	2·5	1615	Source at An Garbh-mheall to the Sea.
96	ALLT NA H-AIRIDHE MÒIRE,	5·5	4·5	2051	An Dubh-Loch to the Sea.
97	RIVER APPLECROSS, .	7·2	21·4	2936	Source near Beinn Bhàn to Inner Sound.
98	RIVER TOSCAIG, . .	6·0	5·8	1945	Source at Creag Ghorm to Inner Sound.
99	RIVER KISHORN, . .	4·2	8·2	1682	Source near An Staonach to Loch Kishorn.
100	AMHAINN CUAG A' GHLINNE,	4·5	4·5	1638	Source to Loch Kishorn.
101	ALLT NAN CARNAN, .	5·0	4·3	2330	Source near Glas Bheinn to Loch Carron.
102	RIVER CARRON, . .	16·0	63·0	3026	Source North of Moruisg to Loch Carron.
103	RIVER CONAN, . . .	41·5	329·9	2220	Source at Càrn Breac to Cromarty Firth.
104	RIVER BLACKWATER, . .	28·0	131·7	3547	Principal Tributary to the Conan.
..	*River Orrin*, ...	25·5	..	2661	Tributaries to the Conan.
..	*River Meig*, ...	22·5	..	3452	
..	*Loch Fannich*, . . .	6·8	..	Wr. 822	Included in Conan Catchment.
		Total, .	461·6		
105	RIVER PEFFERY, . .	9·2	14·5	2669	Source to Cromarty Firth.
106	RIVER SKIACK, . .	13·0	17·3	1508	Source near Cnoc nan Each to Cromarty Firth.
107	ALLT GRAAD, . . .	18·5	46·1	2112	Feur-lochan to Cromarty Firth.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
108	RIVER ALNESS, . .	24·5	78·1	2330	Source near Beinn Tharsuinn to Cromarty Firth.
109	WESTER FEARN BURN, .	8·8	14·0	2080	Source near Càrn Bhren to Dornoch Firth.
110	ALLT NA H-EITEIG, . .	4·0	4·5	864	Source to Dornoch Firth.
111	EASTER FEARN BURN, .	5·2	7·0	1845	Source at Cnoc Leathado na Siorramachd to Dornoch Firth.
112	CRAIGROY BURN, . .	5·5	11·8	1792	Loch Muidh a' Bhlàir to Dornoch Firth.
113	EDDERTON BURN, . .	4·0	7·2	805	Source to Dornoch Firth.
114	RIVER TAIN, . . .	8·0	11·8	1238	Source at Westerglen to Dornoch Firth.
115	STREAM, ...	10·2	25·6	721	Source of Garrick Burn to Nigg Bay.
116	BALNAGOWN RIVER, .	13·8	30·5	2259	Source North of Beinn Tharsuinn to Nigg Bay.
117	GORDONSMILLS BURN, .	9·0	17·7	838	Source at Bogbuie to Cromarty Firth.
118	AVOCH BURN, . . .	8·2	11·2	600	Source to Moray Firth.
119	NEWTON BURN, . .	9·0	12·3	1010	Source North of Cnoc nam Fitheach to Beauly Firth.
120	STREAM, ...	4·8	12·3	400	Source to Moray Firth.
121	RIVER NAIRN, . . .	34·0	129·9	2637	Source at Càrn Ghriogair to the Sea.
122	MUCKLE BURN, . .	21·2	48·8	1314	Source near Càrn á Chrasgie to Findhorn Bay.
123	ALTYRE BURN, . . .	11·0	21·3	1216	Source near Mill Buie to Findhorn Bay.
124	KINLOSS BURN, . .	6·0	12·2	833	Source to Findhorn Bay.
125	RIVER LOSSIE, . . .	16·2	147·3	1711	Loch Trevie to the Sea.
126	BURN OF TYNET, . .	6·2	9·7	987	Source near Millstone Hill to the Sea.
127	BURN OF BUCKIE, . .	5·2	7·2	845	Source near Hill of Clashmadin to the Sea.
128	BURN OF CULLEN, . .	7·8	22·6	1028	Source near Lurg Hill to the Sea.
129	BURN OF FORDYCE, .	4·0	4·8	700	Source to the Sea.
130	BURN OF DURN, . .	5·8	7·7	841	Source to the Sea.
131	BURN OF BOYNE, . .	11·0	21·5	1028	Source near Lurg Hill to the Sea.
132	BURN OF BOYNDIE, .	6·5	10·7	573	Source near Hill of Ord to the Sea.
133	RIVER DEVERON, . .	60·0	474·1	2065	Source at Threestone Hill to the Sea.
..	*River Isla*, ...	20·0	..	1219	Tributary to the Deveron.
134	TORE BURN, . . .	4·0	6·2	637	Source to the Sea.
135	WATER OF PHILORTH, .	10·5	29·7	443	Source to Fraserburgh Bay.
136	STREAM, ...	6·2	22·2	285	Loch of Kininmonth to the Sea.
137	RIVER UGIE, . . .	23·5	131·5	723	Source to the Sea.
138	WATER OF CRUDEN, .	9·5	20·3	435	Source to the Sea.
139	RIVER YTHAN, . . .	37·2	257·3	1006	Source at Wells of Ythan to the Sea.
140	RIVER DON, . . .	80·5	515·7	2382	Source at Càrn Cuilchathaidh to the Sea.
..	*River Ury*, ...	22·0	..	1029	Tributary to the Don.
141	RIVER SPEY, . . .	98·0	943·8	1497	Loch Spey to the Sea.
142	RIVER AVON, ...	37·8	209·7	4296	Principal Tributary to the Spey.
..	*River Dulnan*, . . .	27·2	..	2750	Tributaries to the Spey.
..	*River Feshie*, . .	22·0	..	2994	
..	*River Fiddich*, . . .	17·5	..	2563	
..	*River Truim*, . . .	14·8	..	3175	
..	*River Nethy*, ...	13·5	..	4084	
		Total, .	1153·5		
143	RIVER FINDHORN . .	56·5	307·2	2548	Source at Càrn a' Choire Sheilich to the Sea.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
144	RIVER NESS,	39·0	303·8	2250	Loch Oich to Beauly Firth.
145	RIVER FOYERS,	16·0	107·7	3036	Source to Loch Ness. (Principal Tributaries to the Ness.)
146	RIVER GARRY,	29·5	153·5	3125	Source to Loch Oich. (Principal Tributaries to the Ness.)
147	RIVER MORISTON,	29·0	156·1	3214	Source to Loch Ness. (Principal Tributaries to the Ness.)
..	*River Enrick*,	16·8	..	2224	Feeders to Loch Ness.
..	*River Tarff*,	13·2	..	2929	Feeders to Loch Ness.
..	*River Loyne*,	13·2	..	3268	Tributary to the Moriston.
..	*Loch Ness*,	22·0	..	..	Included in Ness Catchment.
..	*Loch Oich*,	3·8	..	Wr. 105	Included in Ness Catchment.
..	*Loch Quoich*,	7·2	..	Wr. 555	Included in Garry Catchment.
..	*Loch Garry*,	4·5	..	Wr. 258	Included in Garry Catchment.
		Total,	721·1		
148	RIVER BEAULY,	47·2	269·6	3383	Source at Beinn Fhada to Beauly Firth.
149	RIVER FARRAR,	26·8	120·5	3452	Principal Tributary to the Beauly.
..	*River Cannich*,	23·5	..	3771	Tributary to the Beauly.
		Total,	390·1		
150	RIVER LING,	16·0	51·5	2949	Source near Aonach Buidhe to Loch Long.
151	RIVER ATTADALE,	4·0	8·0	1476	Source to Loch Carron.
152	AMHAINN STRATH ASCAIG,	4·2	7·2	1250	Source to Loch Carron.
153	ALLT DHUIRINISH,	4·2	4·3	1466	Source near Beinn Raimh to Inner Sound.
154	ALLT GLEANN UDALAIN,	7·5	9·0	1590	Source to Loch Alsh.
155	AN LETH-ALLT,	4·0	5·7	2757	Source to Loch Duich.
156	RIVER ELCHAIG,	11·2	36·9	2949	Loch Muirichinn to Loch Long.
157	RIVER CROE,	8·2	23·0	3378	Source at Sgùrr a' Bhealaich Dheirg to Loch Duich.
158	RIVER SHIEL,	10·8	25·4	3282	Source near Sgùrr Coire na Feinne to Loch Duich.
159	GLENMORE RIVER,	10·0	19·0	3082	Source near Sgùrr na Creige to Sound of Sleat.
160	AMHAINN A' GHLINNE BHIG,	7·8	15·6	2536	Source at Beinn nan Caorach to Sound of Sleat.
161	ALLT MOR SHANTIG,	4·5	3·5	3196	Source at Ben Sgriol to Sound of Sleat.
162	RIVER ARNISDALE,	7·8	13·3	3317	Source at the Saddle to Loch Hourn.
163	RIVER BARRISDALE,	5·2	9·0	2891	Source near Sgùrr nan Eug Allt to Loch Hourn.
164	AMHAINN GHUSEREIN,	7·2	15·3	3343	Source near Ladhar Bheinn to Sound of Sleat.
165	AMHAINN AOIDH,	7·5	16·2	3083	Source at Luinne Bheinn to Loch Nevis.
166	RIVER CARNACH,	6·5	12·0	2538	Lochan na Cruadhach to Loch Nevis.
167	RIVER MORAR,	17·0	67·7	2818	Source to the Sea.
..	*Loch Morar*,	11·5	..	Wr. 31	Included in Morar Catchment.
168	ALLT CAM,	4·0	4·2	400	Source to the Sea.
169	BRUNERY BURN,	4·8	4·2	1649	Source to the Sea.
170	RIVER AILORT,	8·0	19·2	2853	Source at Beinn Odhar Mhòr to Loch Ailort.
171	RIVER MOIDART,	7·8	16·5	2178	Source near A' Chroit-Bheinn to Loch Moidart.
172	ALLT BEITHE,	4·0	4·5	1769	Source at Ben Laga to the Sea.
173	ALLT OCKLE,	4·0	4·5	1249	Source to the Sea.
174	ACHATENY WATER,	5·5	7·3	1729	Source at Ben Hiant to the Sea.
175	ALLT SANNA,	4·5	4·7	1324	Source at Meall an Tarmachain to the Sea.
176	GLENCRIPESDALE BURN,	4·8	7·2	1873	Source at Meall Lochan nan Lorg to Loch Sunart.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
177	BARR RIVER, . . .	5·0	6·8	1806	Source at Sithean na Rapaiche to Loch Sunart.
178	SAVARY RIVER, . .	4·0	5·0	1806	Source at Sithean na Rapaiche to Sound of Mull.
179	RANNOCH RIVER, . .	6·5	13·3	1395	Source near Caol Bheinn to Sound of Mull.
180	RIVER ALINE, . . .	11·0	40·9	1981	Source at Meall na Creine to Sound of Mull.
181	AMHAINN NA COINNICH,	4·8	9·5	1981	Source at Meall a' Chaoruinn Loch Uisge to the Sea.
182	GLENGALMADALE RIVER,	4·0	5·3	2800	Source at Creach Bheinn to Loch Linnhe.
183	CARNACH RIVER, . .	4·5	12·8	2500	Source at Maol Odhar to Loch Sunart.
184	INVERSANDA RIVER, .	4·2	6·5	2750	Lochan an Iubhair to Loch Linnhe.
185	RIVER SALACHAN, . .	6·2	13·0	2298	Loch nan Dearcag to Loch Linnhe.
186	STRONTIAN RIVER, . .	7·0	15·0	2298	Lochan a' Chothruim to Loch Sunart.
187	RIVER SHIEL, . . .	25·2	99·3	3164	Source near Streap to Loch Moidart.
..	*Loch Shiel*, ...	17·5	..	Wr. 16	Included in Shiel Catchment.
188	RIVER INVERSCADDLE, .	9·5	35·6	2579	Source at Beinn Mheadhoin to Loch Linnhe.
189	NORTH GARVAN RIVER,	4·5	8·0	2250	Source near Meall nan Damh to Loch Eil.
190	DUBH UISGE, . . .	3·8	5·0	2364	Source near Sgùrr an Iubhair to Loch Eil.
191	DUBH LIGHE, . . .	7·5	9·8	2916	Source near Sròn Liath to Loch Eil.
192	FIONN LIGHE, . . .	7·8	10·9	3224	Source at Gulvain to Loch Eil.
193	ANT SUILEAG, . . .	5·8	8·8	2348	Source near Coille Mhòr to Loch Eil.
194	RIVER LOCHY, . . .	18·0	195·9	2250	Loch Lochy to Loch Linnhe.
195	RIVER SPEAN, . . .	43·0	316·3	3757	Principal Tributary to the Lochy.
..	*River Roy*, ...	16·0	..	3700	Tributary to the Spean.
..	*Loch Lochy*, ...	9·5	..	Wr. 93	Included in Lochy Catchment.
..	*Loch Arkaig*, ...	12·0	..	Wr. 140	
..	*Loch Laggan*, ...	7·0	..	Wr. 819	Included in Spean Catchment.
..	*Loch Treig*, ...	5·0	..	Wr. 784	
		Total, .	512·2		
196	RIVER DEE, . . .	85·2	817·2	4241	Source West of Cairn Toul to the Sea.
..	*River Gairn*, ...	19·8	...	3556	Tributary to the Dee.
197	BURN OF MUCHALS, .	3·8	6·5	520	Source to the Sea.
198	COWIE WATER, . . .	11·8	28·7	1231	Source near Leachie Hill to the Sea.
199	CARRON WATER, . .	8·8	17·2	1000	Source to the Sea.
200	CATTERLINE BURN, .	4·8	8·3	493	Source near St John's Hill to the Sea.
201	BERVIE WATER, . .	18·8	50·7	1527	Source near Hill of Gothie to the Sea.
202	STREAM, ...	4·2	9·5	854	Source near Garvock to the Sea.
203	RIVER NORTH ESK, .	41·0	296·6	2731	Source near Wester Balloch to the Sea.
204	RIVER SOUTH ESK, . .	49·5	236·3	3314	Source South of Cairn Bannoch to the Sea.
205	LUNAN WATER, . .	16·0	53·4	708	Source near Forfar to the Sea.
206	BROTHOCK WATER, . .	4·5	18·2	265	Source to the Sea.
207	ELLIOT WATER, . .	6·8	13·8	648	Source to the Sea.
208	CRAIGMILL BURN, . .	8·5	13·7	851	Source near Carrot Hill to the Sea.
209	BARRY BURN, . . .	8·5	7·8	851	Source near Carrot Hill to the Sea.
210	BUDDON BURN, . . .	6·0	9·5	500	Source to Firth of Tay.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
211	DIGHTY WATER, . .	14·0	48·8	1063	Source near Lundie to Firth of Tay.
212	INVERGOWRIE BURN, .	4·2	15·8	630	Source to Firth of Tay.
213	HUNTLY BURN, . .	7·5	14·0	890	Source South of Ballo Hill to Firth of Tay.
214	POWGAVIE BURN, . .	4·8	18·0	547	Source West of Kinuaird to Firth of Tay.
215	POW OF ERROL, . .	8·2	7·7	918	Source to Firth of Tay.
216	RIVER TAY, . . .	93·2	793·2	3374	Source near Beinn Oss to Firth of Tay.
217	River Earn, . . .	52·8	376·8	2500	Principal Tributaries to the Tay.
218	River Isla, ...	44·0	506·3	3502	
219	River Tummel, . . .	57·8	662·1	3000	
..	*River Almond*, . . .	31·5	..	2840	Tributaries to the Tay.
..	*River Lyon*, ...	34·2	..	2887	
..	*River Ericht*, ...	31·0	..	2371	Tributary to the Isla.
..	*River Garry*, ...	30·5	..	3192	Tributary to the Tummel.
..	*River Tilt*, ...	23·0	..	2992	Tributary to the Garry.
..	*Loch Tay*, ...	14·0	..	..	Included in Tay Catchment.
..	*Loch Earn*, ...	6·2	..	..	Included in Earn Catchment.
..	*Loch Ericht*, ...	14·2	..	Wr. 1153	Included in Tummel Catchment.
..	*Loch Rannoch*, . . .	9·2	..	Wr. 668	
		Total, .	2338·4		
220	RIVER LEVEN, . . .	16·0	79·2	1928	Lochan a' Chlaidheimh to Loch Leven.
221	WATER OF NEVIS, . .	14·2	29·9	3700	Source at Binnein Mòr to Loch Linnhe.
222	WATER OF KIACHNISH, .	8·8	18·5	3274	Source at Stob Ban to Loch Linnhe.
223	AMHAINN RIGH, . .	5·5	8·3	2017	Source near Beinn na Gucaig to Loch Linnhe.
224	RIVER DUROR, . . .	5·0	8·3	3284	Source near Beinn a' Bheithir to Loch Linnhe.
225	RIVER LAROCH, . .	4·0	5·5	3362	Source at Beinn a' Bheithir to Loch Leven.
226	RIVER COE, . . .	7·8	21·2	2547	Source North of Stob nan Cabar to Loch Leven.
227	RIVER ETIVE, . . .	17·0	62·1	1407	Source near Beinn Chaorach to Loch Etive.
228	RIVER CRERAN, . .	9·2	26·9	3258	Source near Sgòr na h-Ulaidh to Loch Creran.
229	SALACHAN BURN, . .	4·2	8·0	2883	Source near Fraochaidh to Loch Linnhe.
230	AN IOLA, ...	5·0	6·5	2093	Source near Beinn Mhic na Ceisich to Loch Creran.
231	ALLT EASACH, . . .	4·0	5·3	3058	Source near Beinn Sguliaird to Loch Etive.
232	ABHAIN TEITHIL, . .	5·0	4·5	2857	Source at Meall Garbh to Loch Creran.
233	DEARG ABHAINN, . .	4·0	4·2	2324	Source to Loch Creran.
234	RIVER ESRAGAN, . .	4·0	6·3	2324	Source near Beinn Bhreac to Loch Etive.
235	RIVER KINGLASS, . .	13·0	27·4	3541	Source near Ben Starav to Loch Etive.
236	RIVER LIVER, . . .	4·5	4·3	3242	Source at Beinn Eùnaich to Loch Etive.
237	RIVER NOE, . . .	4·0	6·7	3272	Source to Loch Etive.
238	RIVER AWE, . . .	38·2	321·4	2966	Source near Meall Buidhe to Loch Etive.
..	*Loch Awe*, ...	23·0	..	Wr. 116	Included in Awe Catchment.
239	RIVER NANT, . . .	10·5	17·3	1583	Source near Beinn Dearg to Loch Etive.
240	ALLT AN AISH, . . .	5·0	7·3	1255	Source North of Deadh Choimhead to Loch Etive.
241	LUSRAGAN BURN, . .	5·0	7·8	453	Black Lochs to Loch Etive.
242	RIVER NELL, . . .	10·5	23·4	1516	Source near Càrn Gaibhre to Firth of Lorne.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
243	RIVER EUCHAR, . .	13·2	25·8	1691	Source near Beinn Ghlas to Firth of Lorne.
244	RIVER OUDE, . . .	6·8	11·1	1022	Source at Cnoc nan Gobhar to Loch Melfort.
245	ABHAINN NA CILLE, .	4·8	5·5	1239	Source at Cruach Maolachy to Loch Melfort.
246	BARBRECK RIVER, . .	7·5	9·4	1500	Loch a' Ghille to Loch Craignish.
247	RIVER FINE, . . .	11·0	29·4	2085	Source at Beinn Bhalgairean to Loch Fine.
248	GEARR ABHAINN, . .	12·2	26·9	3106	Source at Beinn Bhuidhe to Loch Fine.
249	RIVER ARAY, . . .	8·8	23·9	1803	Source near Beinn Ghlas to Loch Fine.
250	DOUGLAS WATER, . .	7·0	12·2	1575	Source near Beinn Dearg to Loch Fine.
251	LEACANN WATER, . .	4·0	8·5	1250	Loch Leacann to Loch Fine.
252	RIVER ADD, . . .	19·5	52·8	1421	Loch Sitheanach to Sound of Jura.
253	CUILARSTICH BURN, .	5·0	12·5	700	Source to Loch Fine.
254	THE LUSSA, . . .	4·0	5·0	1087	Source at Beinn Bheag to Loch Sween.
255	ALLT CINN-LOCHA, . .	4·5	9·3	1084	Source near Cnoc Mhadach to Loch Caolisport.
256	BARANLONGART BURN, .	4·5	5·7	1840	Source at Meall Odhar to Loch Caolisport.
257	ORMSARY WATER, . .	6·2	11·7	1840	Source at Sliabh Gaoil to Loch Caolisport.
258	ABHAINN GHILLEAN, .	5·0	7·5	1574	Source near Meall Buidhe to West Loch Tarbert.
259	ALLT LAIRIG AN UINNSINN,	6·2	8·0	1563	Source near Meall Reamhar to Sound of Jura.
260	EAS TORRANTUIRE, .	4·0	5·5	1250	Source at Cruach nam Fad to West Loch Tarbert.
261	SKIPNESS WATER, . .	4·8	5·6	1236	Source near Cruach Doire Leithe to Kilbrannan Sound.
262	CLAONAIG WATER, . .	5·2	11·4	882	Source near Cruach nam Fiadh to Kilbrannan Sound.
26	CLACHAN BURN, . .	4·8	10·9	882	Source at Cruach nam Fiadh to Sound of Jura.
264	BALLOCHROY BURN, .	4·8	5·8	795	Source near Cruach Talatoll to Sound of Jura.
265	TAYINLOAN BURN, . .	4·2	3·2	935	Loch an Fhraoich to Sound of Gigha.
266	CARRADALE WATER, .	12·0	22·6	935	Source near Narachan Hill to Kilbrannan Sound.
267	CLACHAIG WATER, . .	4·8	5·8	1195	Lochan Eich to the Sea.
268	BARR WATER, . . .	8·2	15·6	1195	Source near Cruach Mhic-an-t-Saoir to the Sea.
269	SADDELL WATER, . .	4·5	5·8	1338	Source near Bòrd Mòr to Kilbrannan Sound.
270	GLENLUSSA WATER, .	11·2	21·6	1226	Source to Kilbrannan Sound.
271	MACHRIHANISH WATER,	6·8	21·4	600	Source near Ballivulline Hill to the Sea.
272	BREACKERIE WATER, .	7·8	20·9	1462	Source near Cnoc Moy to the Sea.
273	CONIEGLEN WATER, .	8·8	20·1	1263	Source near The Slate to the Sea.
274	ALLT OSDA, . . .	6·8	6·7	1082	Source near Cnoc Dubh to Loch Fine.
275	ACHAROSSON BURN, .	5·5	7·0	1488	Source near Beinn Bhreac to Loch Fine.
276	KILFINAN BURN, . .	5·5	9·8	1144	Source near Cruach nan Farb to Loch Fine.
277	ARDYNE BURN, . . .	6·0	8·0	1371	Source near Corlarach Hill to Firth of Clyde.
278	GLENTARSAN BURN, .	4·8	5·3	1972	Source near Sgarach Mòr to Loch Striven.
279	BALLIMORE BURN, . .	4·0	4·9	1915	Source near Meall Dubh to Loch Striven.
280	RIVER RUEL, . . .	12·2	36·7	1658	Source near Cruach an Lochain to Kyles of Bute.
281	STRATHLACHLAN RIVER,	5·0	7·5	1564	Source near Tom a' Bhioraain to Loch Fine.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
282	RIVER EACHAIG,	18·8	69·0	2001	Source near Cruach nam Mult to Firth of Clyde.
283	GLEN FINART BURN,	4·2	7·8	2084	Source near Beinn Bhreac to Loch Long.
284	RIVER GOIL,	5·3	15·7	2955	Source near Beinn an Loch to Loch Goil.
285	CROE WATER,	5·0	7·0	2750	Source near Ben Arthur to Loch Long.
286	KINGLAS WATER,	7·2	11·5	3004	Source near Ben Vane to Loch Fine.
287	RIVER FORTH,	64·5	627·9	3192	Source at Ben Lomond to Firth of Forth.
..	*Loch Katrine*,	8·2	..	Wr. 364	Included in Forth Catchment.
..	*River Teith*,	35·0	..	2001	Tributaries to the Forth.
..	*River Devon*,	30·2	..	2072	
..	*Allan Water*,	19·0	..	602	
288	RIVER LEVEN,	27·5	162·3	1621	Source near Innerdouny Hill to the Sea.
..	*River Ore*,	17·0	..	921	Tributary to the Leven.
..	*Loch Leven*,	3·2	..	..	Included in Leven Catchment.
289	RIVER EDEN,	29·8	160·6	670	Source at Damhead to the Sea.
290	LUNDIN BURN,	5·0	6·5	34	Source to Firth of Tay.
291	KINNESS BURN,	5·0	11·2	547	Source near Clatto Hill to the Sea.
292	PITMILLY BURN,	3·2	23·2	317	Source to the Sea.
293	CAMBO BURN,	5·5	4·5	427	Source to the Sea.
294	DREEL BURN,	6·8	13·8	695	Source to Firth of Forth.
295	COCKLEMILL BURN,	7·2	8·7	695	Source to Firth of Forth.
296	KIEL BURN,	3·5	10·5	700	Source to Firth of Forth.
297	WEST BURN,	5·8	12·5	526	Source to the Sea.
298	LYNE BURN,	9·0	18·3	705	Source near Hill of Beath to Firth of Forth.
299	BLUTHER BURN,	12·2	20·0	746	Source to Firth of Forth.
300	POW BURN,	9·2	16·7	349	Source to Firth of Forth.
301	RIVER CARRON,	24·2	95·4	1792	Source at Campsie Fells to Firth of Forth.
302	RIVER AVON,	23·0	78·3	749	Source to Firth of Forth.
303	MIDHOPE BURN,	7·0	12·3	912	Source near Cocklerue to Firth of Forth.
304	RIVER ALMOND,	23·0	146·3	856	Source to Firth of Forth.
305	WATER OF LEITH,	22·2	50·9	1742	Source in the Pentland Hills to Firth of Forth.
306	FRIGATE BURN,	8·5	10·0	800	Source at Torduff Reservoir to Firth of Forth.
307	BRUNSTANE BURN,	7·8	11·0	1250	Source in the Pentland Hills to Firth of Forth.
308	PEFFER BURN,	6·0	18·9	100	Source to Firth of Forth.
309	PEFFER BURN,	8·0	12·0	590	Source near Garleton Hill to the Sea.
310	BEIL WATER,	13·0	23·9	1346	Source in the Lammermuir Hills to the Sea.
311	BROX BURN,	7·0	8·8	1157	Source on Lothian Edge to the Sea.
312	DRY BURN,	6·8	8·5	1157	Source near Bransly Hill to the Sea.
313	THORNTON BURN,	7·2	5·7	1300	Source near Bransly Hill to the Sea.
314	DUNGLASS BURN,	6·5	7·0	1300	Source on Monynut Edge to the Sea.
315	PEASE BURN,	5·2	8·5	909	Source near Ecclie Hill to the Sea.
316	EYE WATER,	21·0	47·3	1153	Source on Monynut Edge to the Sea.
317	RIVER TYNE,	27·8	124·6	800	Source at Tynehead to the Sea.
318	RIVER ESK,	24·8	127·1	1750	Source in the Pentland Hills to Firth of Forth.
..	*River South Esk*,	17·8	..	2136	Tributary to the Esk.
319	NORTH LOW (PART OF),	..	0·3	..	
320	RIVER TWEED (PART OF),	96·5	1204·7	1566	Source at Tweeds Well near Fletchet Hill to the Sea.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
321	RIVER TILL (part of),	..	39·2	..	Principal Tributaries to the Tweed.
322	RIVER TEVIOT,	39·2	436·7	1607	
..	*Whiteadder Water*,	36·5	..	1307	Tributaries to the Tweed.
..	*Ettrick Water*,	30·8	..	2223	
..	*Lyne Water*,	16·2	..	1742	
..	*Jed Water*,	20·2	..	1801	Tributary to the Teviot.
		Total,	1680·6		
323	RIVER CLYDE,	98·5	1173·8	2190	Source near Earncraig Hill to Firth of Clyde at Port Glasgow.
324	RIVER LEVEN,	40·0	314·2	3101	Principal Tributary to the Clyde.
..	*Avon Water*,	26·0	..	1258	
..	*River Kelvin*,	19·5	..	400	Tributaries to the Clyde.
..	*River Nethan*,	15·0	..	1615	
..	*Loch Lomond*,	22·2	..	Wr. 23	Included in Leven Catchment.
..	*Endrick Water*,	29·0	..	1591	Feeder to Loch Lomond.
		Total,	1488·0		
325	KIP WATER,	9·8	15·3	1323	Source near Black Fell to Firth of Clyde.
326	NODDSDALE WATER,	6·8	9·0	1323	Source near Black Fell to Firth of Clyde.
327	GOGO WATER,	5·0	7·5	1500	Source to Firth of Clyde.
328	RIVER IRVINE,	27·5	279·6	933	Source to Firth of Clyde.
..	*River Garnock*,	20·2	..	1711	Tributary to the Irvine.
329	POW BURN,	8·8	21·0	507	Source to Firth of Clyde.
330	RIVER AYR,	38·0	224·8	1527	Source at Upper Reservoir to Firth of Clyde.
331	MILTON BURN,	5·2	5·0	460	Source to the Sea.
332	CHAPELTON BURN,	5·2	3·2	850	Source near Kirk Hill to the Sea.
333	LADY BURN,	4·0	4·1	850	Source near Kirk Hill to the Sea.
334	WATER OF GIRVAN,	34·5	101·0	2162	Loch Girvan Eye to the Sea.
335	RIVER DOON,	34·2	124·7	2000	Dry Loch to Firth of Clyde.
336	WATER OF LENDAL,	4·8	6·3	600	Source to the Sea.
337	RIVER STINCHAR,	28·8	133·1	2162	Source to the Sea.
338	RIVER CREE,	29·2	179·3	1125	Loch Moan to Wigtown Bay.
339	RIVER DEE,	32·8	375·0	2212	Loch Dee to Solway Firth.
..	*Water of Ken*,	27·2	..	2100	Tributary to the Dee.
340	RIVER NITH,	61·2	496·6	1865	Source near Enoch Hill to Solway Firth.
341	RIVER ANNAN,	42·0	370·5	1566	Source near Great Hill to Solway Firth.
342	RIVER ESK (PART OF),	34·8	313·3	2269	Source near Blue Cairn Hill to Solway Firth.
..	*Liddel Water*,	28·0	..	1224	Tributary to the Esk.
343	RIVER COQUET (PART OF),	0·8	0·2	1714	Source to the Sea.
344	RIVER TYNE (PART OF),	..	5·3	..	
345	RIVER SARK (PART OF),	13·5	25·9	762	Source to Solway Firth.
346	KIRTLE WATER,	16·2	32·1	1250	Source near Mid Hill to Solway Firth.
347	POW WATER,	5·2	8·8	300	Source to Solway Firth.
348	LOCHAR WATER,	19·5	50·4	883	Source in Watchman Moor to Solway Firth.
349	URR WATER,	25·2	120·3	1416	Loch Urr to Solway Firth.
350	CARSE POW,	4·2	5·3	1800	Source near Criffell to Solway Firth.
351	SOUTHWICK WATER,	7·5	16·0	1000	Source near Plascow Rig to Solway Firth.
352	BARNHOURIE BURN,	4·2	6·0	700	Source near Clawbelly Hill to Solway Firth.
353	CHAPEL CROFT LANE,	5·5	7·5	600	Source near Tod Fell to Solway Firth.
354	AUCHENCAIRN BURN,	4·0	3·5	1200	Source at Tun Hill to Solway Firth.
355	ABBEY BURN,	6·8	8·5	900	Source at Barclay Hill to Solway Firth.
356	GRANGE BURN,	5·2	8·7	500	Source at Black Eldrick to Solway Firth.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
357	PULWHIRRIN BURN, .	7·5	7·8	1000	Source near Knockendurrick to Wigtown Bay.
358	WATER OF FLEET, . .	13·5	40·7	2331	Source at Cairnsmure of Fleet to Wigtown Bay.
359	SHYRE BURN, . . .	4·8	9·3	1100	Source near Meikle Bennan to Wigtown Bay.
360	MONEYPOOL BURN, . .	6·5	14·0	1000	Source near Clints of Drumore to Wigtown Bay.
361	BISHOP BURN, . . .	7·0	12·5	200	Source near Merton Hall to Wigtown Bay.
362	RIVER BLADENOCH, .	28·2	143·3	1000	Source near Benbrake Hill to Wigtown Bay.
363	WATER OF LUCE, . .	17·2	76·9	1435	Source near Beneraird to Luce Bay.
364	WATER OF APP, . . .	6·0	8·8	1435	Source near Beneraird to the Sea.
365	SOLE BURN, . . .	4·2	9·0	314	Loch Connell to Loch Ryan.
366	GALDENOCH BURN, . .	4·2	5·2	450	Source to the Sea.
367	INNERMESSAN BURN, .	5·2	8·0	751	Source near Cairnscarrow to Loch Ryan.
368	PILTANTON BURN, . .	13·8	29·0	450	Source to Luce Bay.
369	GRAIGOCH BURN, . .	5·0	5·3	592	Source near Broad Moor to the Sea.
370	CLAYSHANT BURN, . .	5·2	4·8	463	Source near Barmore Hill to Luce Bay.
371	SAND MILL BURN, . .	5·5	4·5	400	Source East of Barmore Hill to Luce Bay.
372	MILTON BURN, . .	5·2	6·8	300	Barhapple Loch to Luce Bay.
373	GILLESPIE BURN, . .	5·0	4·5	353	Source to Luce Bay.
374	KILLANTRAE BURN, .	6·2	7·2	253	Source to Luce Bay.
375	KILFILLAN BURN, . .	6·2	13·0	200	Dowalton Loch to Wigtown Bay.
376	BROUGHTON BURN, .	5·5	6·5	226	Source to Wigtown Bay.
377	MONREITH BURN, . .	8·2	10·8	450	Source near Fell of Carleton to the Sea.
378	THE KET, ...	4·8	4·5	450	Source to the Sea.
	SHETLAND ISLANDS.				
379	BURN OF BURRAFIRTH,	7·5	11·5	300	Source near Hill of Colvadale to the Sea.
380	BURN OF ARISDALE, .	4·0	6·3	531	Source near Kame of Sandwick to the Sea.
381	LAXO BURN, . . .	3·2	7·7	686	Source near Hoo Kame to Drury Voe.
382	BURN OF BURRAFIRTH,	3·8	7·3	800	Source near Weisdale Hill to the Sea.
383	UPPER LOCH OF BROUSTER, . . .	4·5	6·0	400	Maamie of Garth to the Sea.
	ORKNEY ISLANDS.				
384	MILL BURN, . . .	4·0	5·3	600	Muckle Water to the Sea.
385	STREAM, ...	8·5	15·0	735	Source near Milldoe to the Sea.
386	LOCH OF STENNESS, .	11·8	52·0	300	Loch of Isbister to the Sea.
387	MILL BURN, . . .	3·5	8·5	881	Source near Ward Hill to the Sea.
388	FORD OF HOY, ...	4·0	7·5	1565	Source at Red Glen to the Sea.
	HEBRIDES.				
389	AMHUINN DHAIL, . .	5·2	7·5	500	Source near Beinn Dhail to the Sea.
390	AMHUINN GHABSUNN O' THUATH,	5·2	7·7	400	Loch Sgeireach to the Sea.
391	AMHUINN NAN CUIG PEGHINNEAN,	4·5	9·8	400	Source to the Sea.
392	GLEANN SHIADEIR, .	6·0	9·7	400	Loch nan Leach to the Sea.
393	AMHUINN GHEIREADHA,	4·5	5·7	400	Source to the Sea.
394	AMHUINN GHRIAIS, .	7·0	18·0	400	Loch Ghriais to Broad Bay.
395	LOCH MOR BHARABHAIS,	8·2	35·4	403	Source to the Sea.
396	LOCH EIRERADH, . .	7·5		572	Source near Rothishat Mhor to the Sea.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
397	AMHUINN CHUIL, . .	4·8	7·0	422	Source to Broad Bay.
398	AMHUINN ARNOIL, . .	8·5	20·0	710	Loch nan Stearnag to the Sea.
399	LOCH A BHAILE, . .	7·0	9·8	500	Loch Béag Dubh Ceann Allabhat to the Sea.
400	AMHUINN CHARLOB-HAIDH,	8·5	15·0	400	Loch na Cleiteachan to the Sea.
401	RIVER LAXDALE, . .	5·5	7·5	900	Source near Beinn Bharab-hais to Broad Bay.
402	RIVER CREED, . . .	10·2	19·6	900	Source near Beinn n' Sgridhe to the Sea.
403	AMHUINN DHUBH, . .	8·8	26·5	710	Source near Stacashal to the Sea.
404	AMHUINN LEIRABHAIDH	5·2	6·9	300	Source to the Sea.
405	AMHUINN MHOR A GHLINNE RUAIDH,	4·8	4·8	1250	Source at Suainabhal to West Loch Roag.
406	AMHUINN CHASLABHAT,	4·5	5·5	1500	Source to the Sea.
407	AMHUINN AN FHORSA, .	6·5	11·7	1500	Source to the Sea.
408	AMHUINN GHISLADH, .	4·0	6·0	1250	Loch Sgannabhal to the Sea.
409	AMHUINN THAMANAB-HAIDH,	4·8	9·5	600	Loch Bheinnisbhal to the Sea.
410	AMHUINN A CHLACHAIN MHOIR,	6·0	13·6	1250	Source near Beinn Mhead-honach to the Sea.
411	AMHUINN GHRIMERSTA,	16·8	43·1	2250	Source near Teilesval to the Sea.
412	RIVER LAXAY, . . .	12·0	27·7	733	Source near Eitshal to the Sea.
413	AMHUINN MHÒR, . .	3·8	5·0	300	Source to the Sea.
414	AMHUINN MHOR CHEANN TARRAB-HAIDH,	3·8	7·3	1000	Source at Cearnabhal to the Sea.
415	AMHUINN SHITHFORD, .	4·0	8·7	300	Source to the Sea.
416	AMHUINN ISGINN, . .	4·5	6·5	1250	Source to the Sea.
417	ABHUINN MHÒR CEANN RESORT,	4·8	10·0	1684	Source to the Sea.
418	RIVER HOUSAY, . .	5·0	5·0	2153	Source at Ullaval to the Sea.
419	ABHUINN MHÒR, . .	3·8	7·0	2153	Loch Ashavat to West Loch Tarbert.
420	MEAVAIG RIVER, . .	4·5	5·8	2250	Source at Teilesval to West Loch Tarbert.
421	SCALADALE RIVER, . .	3·8	5·3	2622	Loch nan Eang to the Sea.
422	STREAM, ...	6·0	9·7	733	Source at Sletteval to the Sea.
423	LOCH NA CISTE, . .	8·0	14·3	757	Source near Marrival to the Sea.
424	HOWMORE RIVER, . .	5·5	22·8	1723	Source near Beinn Mhòr to the Sea.
425	ROE GLAS, ...	6·5	12·2	1227	Loch Snigisclett to the Sea.
	ISLAND OF SKYE.				
426	KILMALUAG RIVER, .	5·5	9·0	1147	Source at Creag Sneosdal to the Sea.
427	RIVER RHA, . . .	4·0	5·5	1523	Source near Bioda Buidhe to Loch Snizort.
428	RIVER CONON, . .	4·0	7·7	1750	Source near Beinn an Laoigh to Loch Snizort.
429	KILMARTIN RIVER, .	6·8	14·3	1750	Source near Creag a' Lain to the Sea.
430	RIVER HINNISDAL, . .	6·0	14·7	1995	Source near Creag a' Lain to Loch Snizort.
431	LEALT RIVER, . . .	6·0	8·0	2360	Source near The Storr to Sound of Raasay.
432	RIVER ROMESDAL, . .	4·2	6·2	2000	Source at Hartaval to Loch Snizort.
433	RIVER HAULTIN, . .	5·0	9·8	2360	Source near The Storr to Loch Snizort.
434	ALLT GARBH, . . .	4·0	6·0	600	Loch Ravag to Loch Snizort.
435	TREASLANE RIVER, .	5·0	5·3	900	Source at Cruachan Glen-ic' Askill to Loch Snizort.
436	ABHUINN GHLINN' UACHDARAICH,	4·0	5·2	868	Source at Ben Aketil to Loch Snizort.
437	ABHUINN MHOR, . .	5·5	8·3	1538	Source near Healaval More to the Sea.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
438	CAROY RIVER,	4·0	4·7	700	Source to Loch Bracadale.
439	OSE RIVER,	6·2	10·5	600	Loch Connan to Loch Bracadale.
440	RIVER SNIZORT,	11·5	30·8	1440	Source at Roineval to Loch Snizort.
441	VARRAGILL RIVER,	7·5	15·1	1000	Source near Broc-bheinn to Sound of Raasay.
442	RIVER DRYNOCH,	5·5	10·0	970	Source at Leathad na Steiseig to the Sea.
443	EYNORT RIVER,	4·2	7·5	1468	Source at Beinn Bhreac to the Sea.
444	RIVER BRITTLE,	5·8	11·8	3167	Source near Sgùrr nan Gillean to the Sea.
445	RIVER SLIGACHAN,	7·0	17·2	3167	Source at Sgùrr nan Gillean to the Sea.
446	ABHUINN CAMAS FHIONNAIRIDH,	4·8	6·3	2649	Source near Garbh Bheinn to Loch Scavaig.
447	BROADFORD RIVER,	5·0	8·5	800	Source near Beinn an Dubhaich to Inner Sound.
448	ABHUINN LUSA,	5·5	5·5	2401	Source near Sgùrr na Coinnich to Inner Sound.
449	ABHUINN CEANN LOCH EISHORT,	6·2	7·8	1839	Source near Beinn na Seamraig to Loch Eishort.
450	ABHUINN CEANN-LOCHA,	4·0	6·0	1839	Source near Beinn na Seamraig to Sound of Sleat.
451	GILLEAN BURN,	4·0	3·7	800	Loch nan Uamh to the Sea.
452	ALLT A' GHLINNE,	3·5	6·0	800	Source to the Sea.
	ISLAND OF MULL.				
453	MINGARY BURN,	4·5	6·2	866	Source at Cruachan Druim na Croisc to the Sea.
454	LOCHAN NA CUILCE,	7·8	13·3	1391	Source at Beinn na Drise to the Sea.
455	AROS RIVER,	6·8	18·7	1391	Source at Coirean Odhar to Sound of Mull.
456	RIVER FORSA,	7·5	17·5	2496	Source near Maol nam Fiadh to Sound of Mull.
457	RIVER BA,	8·8	23·4	1783	Source near Sgulan Mòr to Loch na Keal.
458	ABHUINN BAIL' A' MHUILINN,	4·0	7·0	1837	Source near Coire Bheinn to Loch Scridain.
459	GOLADOIR RIVER,	6·8	14·3	2026	Source near Coire Clachach to Loch Scridain.
460	LUSSA RIVER,	7·8	14·2	2289	Source near Creach Bheinn to Firth of Lorne.
461	BEACH RIVER,	4·2	7·5	1235	Source near Beinn Chreagach to Loch Scridain.
	JURA.				
462	LUSSA RIVER,	5·2	10·2	1066	Source near Ceann Min na Beinne Brice to Sound of Jura.
463	ABHUINN GHLEANN AOISDALE,	4·2	6·0	1564	Source to the Sea.
464	CORRAN RIVER,	4·0	7·5	2571	Source at Paps of Jura to Sound of Jura.
465	ABHUINN NA H-UANAIRE,	6·0	10·1	1339	Source near Glas Bheinn to Sound of Islay.
	ISLAY.				
466	ABHUINN ARAIG,	4·8	7·7	871	Source to Sound of Islay.
467	SALIGO RIVER,	5·0	9·5	200	Loch Còrr to the Sea.
468	UISG AN T-SUIDHE,	9·8	11·2	871	Source to Loch Indaal.
469	RIVER SORN,	6·0	15·7	425	Loch a' Chùirn to Loch Indaal.
470	RIVER LAGGAN,	12·5	32·0	873	Loch Leathan to Laggan Bay.
471	KINTOUR RIVER,	6·0	7·5	1490	Source near Beinn Uraraidh to Sound of Jura.
472	MACHRY RIVER,	5·2	7·5	1136	Source near Sgorr Bhogachain to Laggan Bay.
473	KINTRAW RIVER,	4·8	5·5	800	Source near Beinn Bhreac to Laggan Bay.

TABLE OF REFERENCE—*continued.*

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in Feet.	Remarks.
	ISLAND OF ARRAN.				
474	STREAM, ...	4·2	6·0	2735	Source near Caisteal Abhail to Firth of Clyde.
475	IORSA WATER, ...	8·0	19·9	2500	Source at Loch na Davie to Kilbrannan Sound.
476	GLENROSIE WATER, .	5·5	13·5	2618	Source near Cir Mhòr to Firth of Clyde.
477	MACHRIE WATER, . .	6·8	14·5	1341	Source near Cnoc Dubh to Kilbrannan Sound.
478	BLACK WATER, . . .	6·5	10·5	1649	Source near Cnoc na Croise to Kilbrannan Sound.
479	SLIDDERY WATER, . .	6·2	12·5	1385	Source near Cnoc Dubh to the Sea.
480	TORRYLIN WATER, . .	5·5	9·7	1327	Source near Cnoc an Fheidh to the Sea.

BASINS THAT ARE PARTLY IN ENGLAND.

No. of Basin.	Names of Rivers and Tributaries.	Lengths of Rivers in Miles.	Areas of Basins in Square Miles.	Altitude of Highest Ground near the Source in feet.	Remarks.
319	NORTH LOW . Scotland	..	0·3		
	Do. . England	8·0	24·3		
	Total, . .	8·0	24·6	456	Source to the Sea.
320	RIVER TWEED . Scotland	96·5	1,204·7		
	Do. . England	..	35·3		
	Total, . .	96·5	1,240·0	1,566	Source at Tweeds Well, near Fletchet Hill, to the Sea.
321	RIVER TILL . Scotland	..	39·2		
	Do. . England	49·5	218·2		
	Total, . .	49·5	257·4	2,545	Tributary to the Tweed.
342	RIVER ESK . Scotland	34·8	313·3		
	Do. . England	10·5	137·2		
	Total, . .	45·3	450·5	2,269	Source near Blue Cairn Hill to Solway Firth.
343	RIVER COQUET . Scotland	0·8	0·2		
	Do. . England	50·2	233·6		
	Total, . .	51·0	233·8	1,714	Source to the Sea.
344	RIVER TYNE . Scotland	..	5·3		
	Do. . England	75·5	1,119·0		
	Total, . .	75·5	1,124·3	1,180	Source at Deadwater Moor to the Sea.
345	RIVER SARK . Scotland	13·5	25·9		
	Do. . England	..	2·7		
	Total, . .	13·5	28·6	762	Source to Solway Firth.
	Land undrained by important Rivers.				
	Scotland	..	0·8		
	England	..	3·7		
	Total, . .	..	4·5		

REFERENCE TO THE AREAS OF PORTIONS OF LAND ADJOINING THE SEA COAST UNDRAINED BY ANY IMPORTANT RIVERS.

Letters on Plan.	Areas in Square Miles.	Letters on Plan.	Areas in Square Miles.	Letters on Plan.	Areas in Square Miles.	Letters on Plan.	Areas in Square Miles.	Letters on Plan.	Areas in Square Miles.
a	7·5	b^3	7·9	c^6	7·8	d^9	0·7	e^{12}	43·2
b	3·5	c^3	2·5	d^6	6·7	e^9	26·0	f^{12}	31·4
c	1·0	d^3	2·0	e^6	6·8	f^9	4·8	g^{12}	2·5
d	27·9	e^3	4·2	f^6	1·7	g^9	23·4	h^{12}	2·2
e	6·8	f^3	11·7	g^6	1·3	h^9	9·8	i^{12}	1·3
f	1·0	g^3	1·5	h^6	16·7	i^9	19·9	j^{12}	0·8
g	8·0	h^3	6·0	i^6	5·5	j^9	0·8	k^{12}	2·5
h	5·5	i^3	3·0	j^6	1·5	k^9	80·1	l^{12}	5·5
i	10·5	j^3	3·8	k^6	8·5	l^9	2·5	m^{12}	13·7
j	1·5	k^3	0·7	l^6	32·5	m^9	19·3	n^{12}	1·5
k	8·2	l^3	7·3	m^6	0·7	n^9	22·2	o^{12}	12·9
l	2·8	m^3	0·5	n^6	11·6	o^9	1·3	p^{12}	21·0
m	0·8	n^3	0·8	o^6	12·7	p^9	1·5	q^{12}	20·7
n	1·0	o^3	1·0	p^6	46·0	q^9	16·5	r^{12}	1·5
o	6·5	p^3	1·5	q^6	12·5	r^9	7·0	s^{12}	3·0
p	4·7	q^3	18·7	r^6	16·8	s^9	12·5	t^{12}	11·2
q	6·2	r^3	6·8	s^6	7·2	t^9	12·2	u^{12}	1·72
r	5·1	s^3	2·2	t^6	16·0	u^9	20·8	v^{12}	1·0
s	5·5	t^3	2·8	u^6	10·3	v^9	5·2	w^{12}	2·8
t	9·9	u^3	1·5	v^6	0·5	w^9	1·8	x^{12}	13·7
u	37·2	v^3	11·0	w^6	17·0	x^9	0·5	y^{12}	1·7
v	18·5	w^3	7·3	x^6	12·3	y^9	13·4	z^{12}	19·0
w	5·9	x^3	5·0	y^6	7·5	z^9	2·0	a^{13}	9·0
x	6·2	y^3	5·5	z^6	1·2	a^{10}	3·0	b^{13}	17·9
y	13·7	z^3	13·5	a^7	20·0	b^{10}	7·3	c^{13}	2·7
z	1·3	a^4	31·3	b^7	17·9	c^{10}	4·3	d^{13}	7·2
a^1	2·5	b^4	4·5	c^7	1·3	d^{10}	11·5	e^{13}	37·3
b^1	2·2	c^4	7·8	d^7	4·7	e^{10}	3·0	f^{13}	53·1
c^1	2·0	d^4	4·4	e^7	2·0	f^{10}	4·3	g^{13}	104·0
d^1	4·5	e^4	1·5	f^7	3·3	g^{10}	2·0	h^{13}	100·3
e^1	1·2	f^4	7·8	g^7	24·8	h^{10}	7·2	i^{13}	80·4
f^1	3·5	g^4	9·0	h^7	87·5	i^{10}	8·0	j^{13}	12·2
g^1	10·3	h^4	4·3	i^7	1·2	j^{10}	2·5	k^{13}	9·2
h^1	2·5	i^4	2·5	j^7	20·3	k^{10}	16·9	l^{13}	3·5
i^1	8·0	j^4	0·7	k^7	6·0	l^{10}	7·8	m^{13}	4·2
j^1	5·0	k^4	0·5	l^7	6·2	m^{10}	10·2	n^{13}	1·0
k^1	3·0	l^4	24·7	m^7	18·9	n^{10}	11·0	o^{13}	0·8
l^1	1·2	m^4	13·5	n^7	15·0	o^{10}	10·3	p^{13}	21·9
m^1	1·5	n^4	1·3	o^7	19·1	p^{10}	5·2	q^{13}	2·0
n^1	11·4	o^4	3·5	p^7	2·0	q^{10}	1·7	r^{13}	1·0
o^1	2·1	p^4	1·7	q^7	5·5	r^{10}	1·5	s^{13}	14·0
p^1	2·5	q^4	0·8	r^7	7·2	s^{10}	3·6	t^{13}	93·6
q^1	0·5	r^4	2·5	s^7	2·5	t^{10}	6·5	u^{13}	4·0
r^1	2·0	s^4	2·2	t^7	1·5	u^{10}	3·5	v^{13}	19·7
s^1	1·0	t^4	14·5	u^7	9·5	v^{10}	1·7	w^{13}	12·6
t^1	2·5	u^4	6·5	v^7	12·9	w^{10}	47·0	x^{13}	26·1
u^1	7·5	v^4	0·8	w^7	2·5	x^{10}	7·5	y^{13}	7·3
v^1	5·2	w^4	14·2	x^7	17·5	y^{10}	20·3	z^{13}	13·7
w^1	29·4	x^4	3·0	y^7	9·3	z^{10}	9·7	a^{14}	63·1
x^1	1·5	y^4	10·2	z^7	15·2	a^{11}	3·0	b^{14}	20·6
y^1	16·3	z^4	2·3	a^8	14·3	b^{11}	24·8	c^{14}	38·4
z^1	10·0	a^5	3·0	b^8	3·0	c^{11}	13·0	d^{14}	1·5
a^2	6·8	b^5	5·3	c^8	16·2	d^{11}	6·5	e^{14}	3·2
b^2	50·7	c^5	2·2	d^8	3·2	e^{11}	29·2	f^{14}	40·0
c^2	21·7	d^5	4·5	e^8	2·8	f^{11}	1·2	g^{14}	24·5
d^2	1·3	e^5	2·8	f^8	2·2	g^{11}	6·3	h^{14}	3·2
e^2	11·2	f^5	1·5	g^8	0·5	h^{11}	2·8	i^{17}	29·7
f^2	23·4	g^5	9·2	h^8	0·8	i^{11}	2·2	j^{14}	31·7
g^2	12·8	h^5	10·0	i^8	8·7	j^{11}	19·0	k^{14}	87·1
h^2	14·0	i^5	8·7	j^8	6·8	k^{11}	3·0	l^{14}	47·2
i^2	19·4	j^5	11·0	k^8	18·2	l^{11}	11·5	m^{14}	37·4
j^2	3·0	k^5	12·5	l^8	19·2	m^{11}	14·0	n^{14}	21·7
k^2	3·0	l^5	1·0	m^8	2·0	n^{11}	1·8	o^{14}	22·5
l^2	4·5	m^5	1·2	n^8	14·5	o^{11}	3·2	p^{14}	37·6
m^2	7·3	n^5	3·8	o^8	0·2	p^{11}	3·8	q^{14}	30·0
n^2	3·2	o^5	5·7	p^8	11·3	q^{11}	19·7	r^{14}	5·6
o^2	0·8	p^5	6·8	q^8	0·7	r^{11}	13·7	s^{14}	8·7
p^2	2·0	q^5	14·5	r^8	6·0	s^{11}	1·0	t^{14}	3·8
q^2	11·3	r^5	2·0	s^8	13·0	t^{11}	1·8	u^{14}	32·0
r^2	17·7	s^5	12·7	t^8	2·8	u^{11}	1·0	v^{14}	26·9
s^2	3·8	t^5	3·5	u^8	1·7	v^{11}	4·7	w^{14}	12·5
t^2	11·5	u^5	1·3	v^8	11·4	w^{11}	8·0	x^{14}	2·8
u^2	14·2	v^5	1·0	w^8	4·8	x^{11}	34·5	y^{14}	2·2
v^2	13·0	w^5	4·3	x^8	0·8	y^{11}	75·0	z^{14}	4·5
w^2	25·0	x^5	35·6	y^8	2·2	z^{11}	345·5	a^{15}	0·7
x^2	19·3	y^5	10·4	z^8	16·8	a^{12}	12·8	b^{15}	29·0
y^2	2·3	z^5	14·6	a^9	5·0	b^{12}	95·3		
z^2	3·5	a^6	9·0	b^9	3·2	c^{12}	16·0	Total,	4,835·1
a^3	3·7	b^6	11·1	c^9	6·5	d^{12}	13·7		

SUMMARY.

	Square Miles.
Total Area of Catchment Basins,	24,926·4
Total Area Undrained by important Rivers,	4,835·1
Total Area of Small Islands,	644·3
General Total,	30,405·8

SALMON FISHERIES.

APPENDIX.

TWELFTH ANNUAL REPORT TO THE FISHERY BOARD FOR SCOTLAND

ON THE

SCOTTISH SALMON FISHERIES IN 1893

BY

WALTER E. ARCHER, F.R.S.E.,

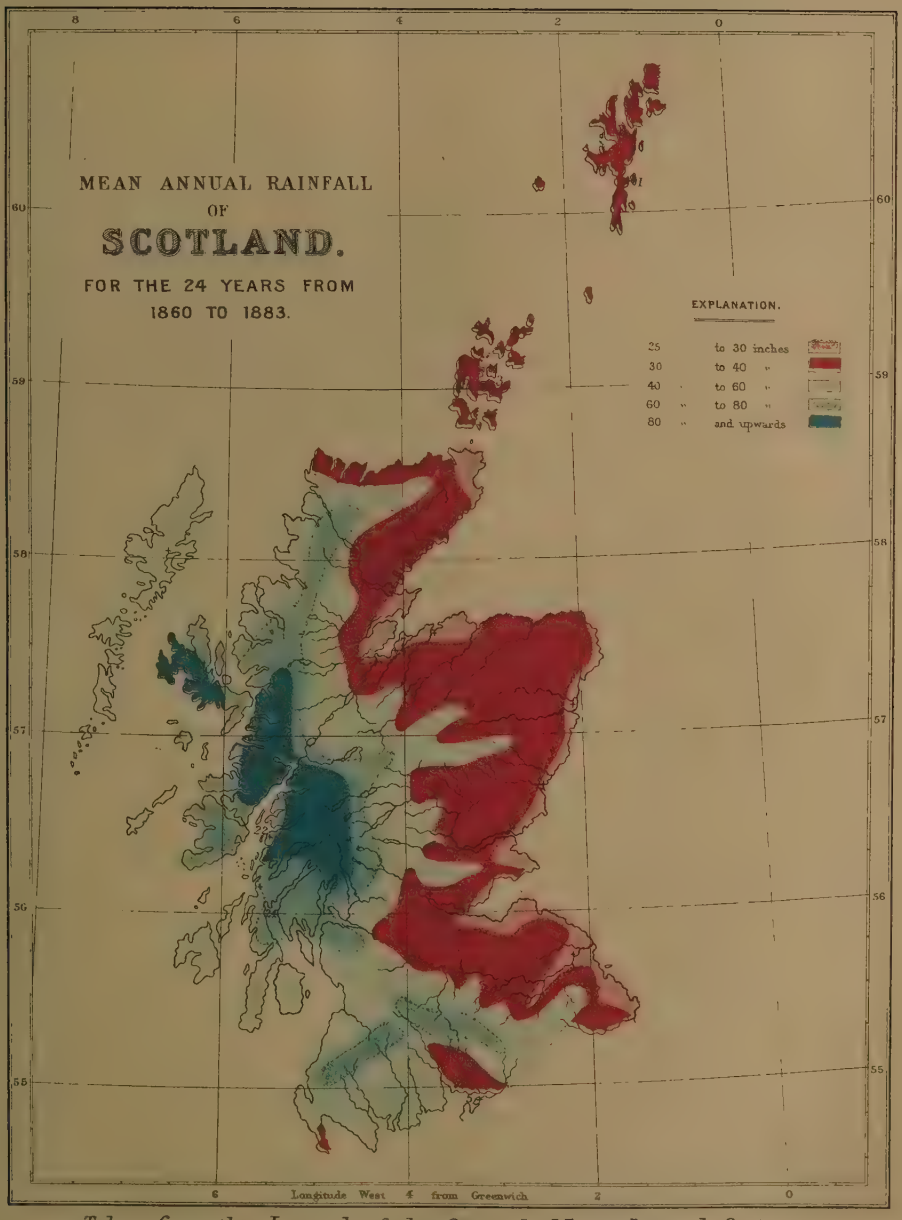
INSPECTOR OF SALMON FISHERIES FOR SCOTLAND.

TABLE OF CONTENTS.

	PAGE
Assessed values or rentals of Salmon Fisheries,	5
Relative productiveness of upper, lower, and sea-coast Salmon Fisheries, respectively,	6
Advantages of restricting commercial fisheries to tidal waters,	6
Extent of salmon waters of Scotland,	7
Fresh waters shown by Maps of Catchment Basins and of Rainfall,	8
Salmon Fisheries divided into four divisions,	8
Description of First or South-Eastern Division,	9
Description of Second or North-Eastern Division,	10
Description of the Third or Western Division,	11
Description of the Fourth or South-Western Division,	13
Summary,	13
Explanation of differences between assessed value and productiveness of Fisheries in Fourth Division,	16
Influence of the exceptional characteristics of Fisheries in the Third Division on the operation of the Acts,	17
Protection of Fish at Spawning Time,	20

NOTES TO SALMON FISHERY REPORT.

I. The following Queries have been sent to Clerks of District Boards,	21
II. Report by the Inspector of Salmon Fisheries on the Alleged Illegal Use of Bag-Nets in the Morar District,	47
III. Report by the Inspector of Salmon Fisheries, on the Proposed Alteration of the Close Time for Rod Fishing in the Rivers Isla and Ericht, Tributaries of the River Tay,	49
IV. Report by the Inspector of Salmon Fisheries on Crown Unchartered Inland Waters in Scotland,	51
V. Report by the Inspector of Salmon Fisheries on the Recent Destruction of Fish in the River Doon,	60
VI. Report by the Inspector of Salmon Fisheries on a Petition from the Earl of Galloway praying for the Extension of the Annual Close Time in the District of the River Bladenoch,	63
VII. Annual Close Time applicable to the Scotch Salmon Rivers,	64
VIII. List of Chairmen and Clerks of Salmon Fishery District Boards, with their Addresses. Based on Information obtained by Circular from Sheriff-Clerks, &c., in obedience to request from Secretary for Scotland,	67
IX. Natural History Notes in Norway,	68



Taken from the Journal of the Scottish Meteorological Society (Third series N° II.) by kind permission of the Council.

REPORT.

I HAVE the honour to submit my Annual Report to the Fishery Board for Scotland for the year 1893.

In the Fishery Board's Report for the present year a return, furnished by the county and burgh assessors of Scotland, is given, showing the assessed values or rentals of the salmon fisheries of Scotland, distinguishing between those inside and those outside the estuary lines. From this return it will be seen that the assessed value or rental of the salmon fisheries regulated by the general Salmon Fishery Acts of Scotland amounted in 1892 to £103,688, 12s. 9d.* Of this sum £69,238, 14s. 8d., or 67 %, represented the value of the fisheries inside the estuary lines, and £34,449, 18s. 1d., or 33 %, that of the fisheries outside. The assessed values or rentals of the fisheries inside the estuary lines, attaching respectively to the upper and lower proprietors, are not distinguished in the above statement. But they may be estimated approximately, as returns have been received from most of the districts where Boards have been formed, distinguishing the assessed values or rentals of the fisheries of the upper proprietors from those of the lower proprietors. These returns represent an aggregate rental of £80,500, 16s. 9d., or about four-fifths of the total assessed value or rental of the salmon fisheries, of which £30,205, 10s., or 38 %, is referable to the upper proprietors, and the remainder to the lower proprietors, both inside as well as outside the estuaries. It should, however, be mentioned that in some districts a proprietor owns fisheries both above and below the division between the upper and lower heritors, and that, in such cases, an estimate has been made of the approximate value attaching to such fisheries respectively. If the comparative values of the fisheries of the lower proprietors, as compared with those of the upper proprietors, bear the same proportion to one another when taken over the total assessed values or rentals of the salmon fisheries as they do when taken over the amount for which they are distinguished, the comparative value of the fisheries may be divided approximately as follows:—The sea coast fisheries, that is to say, the fisheries outside the estuary lines, at £34,449, or 33 %, the fisheries inside the estuary lines belonging to the lower proprietors at £30,356, or 29 %, and those belonging to the upper proprietors at £38,883, or 38 %. Although such an estimate represents approximately the assessed values or rentals of the fisheries in the sea, in the lower waters and in the upper waters respectively, they do not necessarily show the relative productiveness of these fisheries. It is clear that the proportion which the assessed value or rental bears to the take of fish is influenced to a great extent by the cost of fishing. A considerable amount of evidence was given before the Select Committee of the House of Lords

Assessed values or rentals of Salmon Fisheries.

* This amount is exclusive of the value of the fisheries in the Counties of Berwick Roxburgh, Selkirk, and Peebles, which are situated within the limits of the Tweed District, and are, therefore, regulated by the Tweed Salmon Fishery Acts.

appointed in 1860 to enquire into the state of the salmon fisheries, to the effect that fishing in the sea by means of fixed nets (the ordinary method of fishing those waters) was much more expensive than fishing in the rivers with net and coble.* If this is so, the proportion of fish taken in the sea compared with those taken within the estuary lines must be considerably greater than is indicated by the assessed values or rentals. I have, however, received some interesting statistics regarding this question of more recent date. These statistics, as far as they go, tend to show that the expense of working fixed nets, compared with the expense of working net and coble, is not so great as was stated before that Commission. It may further be added that the fisheries from which these statistics are taken were referred to before that Commission as examples of the greater relative expense of the former than of the latter method of fishing. The expense, however, of fishing, depends so much on local conditions that I hesitate to make an estimate on this matter without further evidence.

Relative productiveness of upper, lower, and sea-coast Salmon Fisheries, respectively.

It should be mentioned, on the other hand, that the assessed values or rentals of the fisheries of the upper proprietors is greater in proportion to the number of fish killed than those of the lower proprietors. For the value of the fisheries of the upper proprietors is not that of the actual fish killed, but to a great extent the value of these waters for sporting purposes.

Under these circumstances, therefore, although the assessed values or rentals do not show the actual relative productiveness of the fisheries in these several waters, yet it may safely be said that *at least* one-third of the salmon caught in Scotland are taken on the open sea coast, in some cases many miles from the mouths of rivers; while, if the evidence given before the Committee of the House of Lords regarding the relative cost of fishing by means of fixed nets and net and coble still holds good, such a proportion is very considerably under the mark.

Advantages of restricting Commercial Fisheries to tidal waters.

The value of these fishings affords positive evidence that salmon not only can be, but are taken in large numbers while moving along the open sea coast, and shows further that the markets already draw a great part of their supplies from waters situated even outside the limits of the estuaries, and gives, therefore, additional force to the recommendation I ventured to submit in my Report on Crown Unchartered Inland Waters, viz.:—'that the principal object to be aimed at in the public interest is to 'confine the commercial fisheries, as far as possible, to the tidal waters, and 'to afford the fish every possible protection when once they have reached 'the fresh waters.' The evidence I have already put forward in previous reports seems to leave no reasonable doubt but that the salmon fishing industry would be very much developed, and would afford employment to many more persons, if confined as far as possible to tidal waters. In addition to the evidence already given, I would beg leave to point out that fishing in the open sea not only affords space for a greater number of fishers, but is capable of greater control. For in the sea salmon are constantly moving along the coast; there are no obstructions to delay their progress, or to cause them to collect in the same locality for days and weeks; indeed, the only hindrances to their free passage are the nets used for their capture. If, therefore, such nets were removed for a certain time during each week, it would insure the protection of a proportion of every run of fish, provided that fishing in fresh waters was restricted to fair and legitimate angling for recreative purposes only. The question of the development of the sea coast salmon fisheries acquires greater importance at the present time, when the best mode of dealing with the Crown sea fisheries

* See 'Minutes of Evidence,' *Russell*, 679, 680, 682, 684; *Speedie*, 1347, 1348; *Rutherford*, 1403, 1404; *Cathcart*, 1585; *Grant*, 1765, 1766; *Young*, 836; *Dunbar*, 967-970; *Gray*, 3020; *Foley*, 3938.

is being considered. It appears, from the Report of the Commission on Crown Rights in Scottish Salmon Fisheries, that the salmon fisheries still in the possession of the Crown amounted in 1889 to an annual rental of not quite £6000, but in addition there was a large extent of coast where fishing was not at present carried on. It was said, however, by one of the Commissioners, that it might be assumed that all the sea fishings of the Crown which could be profitably fished had been sold or let, and that the other places, either from their rocky character or otherwise, were unsuited for fishing. This may be the case, but, in the face of the experience I have had during the last ten years, I should hesitate to assume that it is so. A similar statement was made to me when I first took up the salmon fisheries in Norway, referred to in my last annual report. I was informed, both by fishermen and others, that every place where fishing could be carried on had been tried, and that it was not found profitable to fish except at the places then in use. Indeed, it was further said that fishing, even at many of these places, would be abandoned as soon as the nets were worn out, as a three days' weekly close time, which had come in force the previous year, had rendered fishing unremunerative. It will be seen, however, by reference to Note 9, appended to this Report, how completely these forecasts were falsified. The provisions (1) of a weekly close time, which enabled a proportion of every run of fish to reach the fresh waters, and (2) of their protection when there, were followed by an increased number of fish being caught. These fish, however, were not only caught at the existing stations, but new fishing stations were started, and many of them in places which had previously been found unprofitable. It will be seen, in the Note above referred to, that whereas only 76 nets were being fished on the sea coast in 1883, they numbered 229 in 1892. There is further evidence to show that fishing need not be restricted to the places at present in use, from the fact that many in Scotland, formerly fished with profit, have since been abandoned. Such evidence, taken collectively, shows that the conditions favourable to the development of the sea coast salmon fisheries are not so much the want of suitable fishing places as of a sufficient stock of fish; while evidence given in my last annual report and in my report on Crown Unchartered Inland Waters tends to show that the stock of fish may be increased by prohibiting fishing in the confined waters where fish collect.

I venture, therefore, to submit that, in considering the best method of dealing with the Crown sea fisheries, the question of devising some means for compensating the owners of fishings in confined waters and suppressing their nets should first be carefully considered.

It will further be observed, from the Fishery Board's Report, that the returns of the assessed values or rentals of the fisheries are divided under four heads, so as to show the relative value of the salmon fisheries in different parts of Scotland.

Extent of Salmon waters of Scotland.

In dealing with the question of the relative productiveness of the salmon fisheries, it would seem desirable, in the first place, to review the extent of the salmon waters of Scotland. At the outset, however, I may say that it is not my intention to enter into the consideration of all the many conditions which may affect the productiveness of the salmon fisheries in each district. Indeed, the consideration of such a question is impossible with our present limited knowledge. For, besides the effects of human agencies, there are natural conditions we are wholly ignorant of which may enable one river to support a greater quantity of fish-life than another. It may, however, fairly be said that the principal factor in the salmon-producing capabilities of any country must always be the extent of fresh waters open to salmon. It is true the idea is periodically revived that salmon breed in the sea. Evidence, however,

does not bear out such a supposition. On the contrary, there seems no reasonable doubt that such a theory is entirely erroneous. For, in the first place, we find that salmon push up rivers, overcoming great obstacles, in order to deposit their eggs in fresh water, and in the second place, that the eggs of salmon can be hatched artificially in fresh water, whereas attempts to do so in salt water have failed.* Therefore, notwithstanding the fact that large numbers of salmon are caught on the coast, and that the configuration of the coast has an important bearing on the facilities which exist for their capture, yet, as the eggs are deposited and the fry pass the first period of their existence in the fresh waters, it is the extent of such waters which must indicate generally the salmon-producing capabilities of a country.

Fresh waters shown by Maps of Catchment Basins and of Rainfall.

In order to show graphically the extent of these waters, a map is appended to the Fishery Board's Report showing the catchment basins of the rivers of Scotland. Accompanying this map will be found a table of reference giving the names of rivers and tributaries, the length of rivers in miles, the areas of the catchment basins in square miles, together with the altitude of the highest ground near the source. The question, however, of the size of rivers, that is to say, of the volume of water they discharge, is complicated and difficult. In dealing with a wide area over a number of years the volume of water discharged by a river is equivalent to the amount of rain falling in the catchment basin, less that returned to the atmosphere by evaporation and that absorbed by animal and vegetable life. The amount of rain falling in each catchment basin, however, can only be ascertained by observations taken at numerous stations for a number of years and for the same term of years. It would further be necessary to calculate the mean height of the catchment basins and the mean height of the rain gauges within their area, as the rainfall is largely influenced by the physical configuration of the surface. Considering the very general nature of the conclusions which it is possible to draw as to the salmon-producing capabilities of each river from the volume of water which it brings down, the time and labour spent in making such calculations would certainly not be repaid. But general conclusions may be drawn as to the water-yielding capabilities of the rivers of Scotland by comparing the map of the catchment basins with the map appended to this report showing the mean annual rainfall. I am indebted to the Council of the Scottish Meteorological Society for permission to reproduce this map, which accompanies a paper on the subject of the rainfall of the British Islands, by Dr Buchan.† In this map Scotland is shaded into five divisions. These shadings show the districts where the mean annual rainfall is from 25 to 30 inches; from 30 to 40 inches; from 40 to 60 inches; from 60 to 80 inches; and, lastly, above 80 inches. These averages were computed from observations of the rainfall made at 547 stations, over a varying period of years, and were reduced, in a manner fully described by Dr Buchan in the paper to which reference has already been made, to the same 24 years—from 1860 to 1883. The returns of the rentals or assessed values of the salmon fisheries are divided under four heads, as has already been stated. In the first division are included the rivers falling into the North Sea; in the second those falling into the Moray and Pentland Firths; in the third the short steep rivers which empty themselves into the Atlantic; and in the fourth and last division

Salmon Fisheries divided into four divisions.

* Dr Day gives an account of his attempts to hatch salmon in salt water on p. 37 of his book *British and Irish Salmonidæ*.

† 'The Climate of the British Islands' (Third Paper). *The Annual Rainfall of the British Islands*, by Alexander Buchan, Met. Sec., Journal of the Scottish Meteorological Society (Third Series, No. II.).

the rivers of the south-west, which rise in the mountain masses of Dumfriesshire and Ayrshire.

Description of First or South-Eastern Division.

The first division embraces all salmon fisheries from and including the district of the river Forth, to and including the district of the river Ugie, that is, from the boundary between the counties of Haddington and Berwick on the south to Cairnbulg Point on the north. The water-parting of this division is—on the north, a line drawn from the vicinity of Cairnbulg Point through the Cairngorm and Ben Muich Dhui Mountains, round the north end of Loch Ericht to Ben Alder; on the west, from Ben Alder by an irregular line through the Moor of Rannoch and southward to Ben Lomond; on the south, from Ben Lomond by a winding line drawn through the Campsie Fells and Pentland Hills to the Moorfoot Hills, and from thence continued along the Lammermuir Hills to the sea. The largest rivers are the Forth, Tay, North and South Esks, the Dee and the Don. The first four-named rivers, with their numerous tributaries, rise in the Highlands, and flow in a south-easterly direction across the lowland depression which separates the Highlands from the Sidlaw and Ochil Hills and the Campsie Fells. The Dee and Don, whilst separated from the rivers flowing into the Moray Firth by the water-parting extending from the Cairngorm and Ben Muich Dhui Mountains to the vicinity of Cairnbulg Point, are also cut off from the great southern rivers by the mountain masses extending from central Perthshire towards Stonehaven. Dr Buchan, in the paper already referred to on 'The Annual rainfall of the British Islands,' states that the breakdown of the watershed of Scotland between the Firths of Forth and Clyde causes a truly western rainfall to overspread the western parts of Perthshire, Stirlingshire, and Dumbartonshire, and the extension through Kinross-shire of a rainfall of fully 40 inches, which occurs nowhere else over comparatively level plains so far to the east of the watershed separating the western and eastern districts. A study of the map of the mean annual rainfall shows the effect of this feature on the rivers draining these counties. It will be observed that the principal tributaries of the Forth and Tay rise in the region of the greatest rainfall; that the tint indicating a rainfall of 60 inches and upwards extends eastwards to the centre of Loch Rannoch, to the upper end of Loch Tay, and almost to the junction of the Forth and Teith; that over the greater portion of the catchment basins of these rivers there is an annual rainfall of 40 inches and upwards, which extends so far eastward as to include the upper waters of the North and South Esks. In the region drained by the rivers Dee, Don, Ythan, and Ugie, the climatic conditions are very different, as in no part of the catchment basin of these rivers does the mean annual rainfall reach 40 inches. The only parts of the first division where the average rainfall falls short of 30 inches, are (1) a narrow strip along the East Coast, from Peterhead to Burntisland, and (2) the low grounds of Mid and East Lothian. Having drawn attention to the rainfall in the different portions of this division, I may now pass on to consider the area of the catchment basins. In dealing with this subject I have omitted to take into consideration any rivers whose drainage area was less than 20 square miles, as such rivers can have but little effect on the productiveness of the salmon fisheries.

It will be seen, from the map of the catchment basins, that there are twenty-five rivers in this division having a drainage area of over 20 square miles respectively, the total drainage area of these rivers being 6543 square miles. The Board's previous Reports, however, show that a considerable extent of this area is closed to salmon, either by obstructions or pollutions. If such waters are left out it will be found that the drainage area of those to which salmon have access does not exceed

5203 square miles.* Besides, however, the rivers given in the footnote, there are several from which, although the salmon are not totally debarred, there is no reasonable doubt that their productiveness is considerably injured by such causes. On the other hand, it should be observed that, when waterfalls prevent salmon having access to the tributaries of rivers, the drainage area of such tributaries cannot be entirely left out of account in estimating the extent of fresh waters open to salmon. For, although salmon cannot ascend the tributary itself, the water which it brings down helps to swell the volume of the main stream to which they have access.

Description of Second or North-Eastern Division.

The second division embraces all salmon fisheries from and including the district of the river Deveron to and including the district of the river Grudie or Dionard. The eastern limit is Cairnbulg Point, and the western limit Cape Wrath. The rivers of this division are separated by the remarkable depression of Glenmore, which extends from the Moray Firth on the east coast through Loch Ness and Loch Lochy to Loch Linnhe on the west coast. The water-parting of the rivers lying to the east of Glenmore has already been noticed in the first division, viz.:—a line drawn from the vicinity of Cairnbulg Point through the Cairngorm and Ben Muich Dhui Mountains to the mountains at the north end of Loch Ericht, while the water-parting of the rivers to the north of Glenmore runs from the vicinity of Cape Wrath in an almost north and south direction, keeping close to the western shore to Ben Aden at the head of Loch Nevis.

The rivers to the east of Glenmore similarly to the Dee, Don, Ythan, and Ugie in the first division lie in a dry region. In no part of this region does the rainfall exceed 40 inches, except about the head waters

* The names and drainage areas of the rivers in this division from which salmon are debarred by impassable falls, together with the names of the districts in which such rivers are situated, are given in the following table. It may be mentioned that the measurements were made on Bartholomew's Reduced Ordnance Survey Maps, on the scale of 2 miles to 1 inch, in the same manner as that adopted by Dr R. H. Mill in his paper on 'The Clyde Sea Area,' viz. :—the watersheds were first marked on the map in red ink, and then traced on transparent paper divided into squares one-tenth of an inch in the side. The number of squares occupied by each drainage area was counted, and, divided by 25, gave the superficies in square miles. The falls which obstruct salmon are taken from the Board's previous Reports, where they will be found fully described.

District.	River.	Drainage Area in Square Miles.
Forth,	Stream flowing out of Loch Ard; and Duchray Water,	41
,,	Finglas,	15
Tay,	Tummel,	305
,,	Lochay,	42
,,	Ericht,	175
,,	Isla,	63
,,	Tilt,	53
,,	Bruar,	27
,,	Fender Burn,	7
	Total,	728

The rivers in this division mentioned in the Board's Reports as being practically closed to salmon, owing to pollutions, are :—the Devon, Carron, Avon, Almond, Fifeshire Leven, and the Leith. The drainage area of these rivers collectively is 612 square miles. With reference to the last-named river, it may, however, be mentioned that great efforts have been made to purify it, and that trout fry from Sir James R. Gibson Maitland's fishery at Howietown have recently been introduced. Its waters are, however, at present completely closed to migratory salmonidæ, owing the numerous mill dams along its whole course.

of the Spey and Findhorn, where it is from 40 to 60 inches. In the region which lies to the north of Glenmore, the map of the mean annual rainfall shows the extension eastwards of the west coast rainfall by the mountains of Sutherland. The rivers of Sutherland, Ross and Cromarty, and Inverness, which drain the region lying to the eastward of the water-parting extending from Cape Wrath to Ben Aden, have, in most cases, the greater part of their course within the limits of the rainfall of 40 inches or upwards; the western tributaries of the rivers falling into the Cromarty and Dornoch Firths rise within the limits of the rainfall of 60 inches, or upwards, while the extreme western tributaries of the Beauly and Ness are within the area of the greatest rainfall. Quite different, however, are the climatic conditions of Caithness, as in no part of this county does the average rainfall rise to 40 inches, while in the north-eastern portion the average falls short of 30 inches.

The principal rivers in the second division are the Spey, the Ness, the rivers flowing into the Cromarty and Dornoch Firths, the Deveron, the Beauly, the Findhorn, the Helmsdale, the Thurso, and the Naver. There are, however, thirty-four rivers, with catchment basins exceeding 20 square miles, which drain a surface area of 6277 square miles. Pollutions do not exist to an extent sufficient to render any of the rivers salmonless, but obstructions reduce the drainage area of the rivers open to salmon to 5745 square miles.*

Description of the Third or Western Division.

The third division embraces the salmon fisheries from and including the district of the river Inchard to and including the district of the rivers Clyde and Leven. The northern limit of this division is Cape Wrath, the southern Fairlie Head, the latter point being the southern limit of the district of the rivers Clyde and Leven. It is, however, unnecessary to include the river Clyde in any division, as its waters are practically salmonless. If the catchment basin of the Clyde is omitted, the water-parting of this division extends from Cape Wrath to Ben Aden, as described in the second division, from Ben Aden eastward to the mountains lying to the north-west of Loch Ericht, from this point following the same line as that described as the western and southern boundary of the first division, as far as the Campsie Fells, and thence westward to the coast. The rivers flow westwards, emptying themselves into the Atlantic.

The rainfall of the third division is much greater than that of the first and second divisions. Dr Buchan states, in the paper already referred to, that:—'The West Highlands present the most extensive region of heaviest 'rainfall in the British Islands. The mountain masses along whose slopes 'the rainfall is precipitated, offer practically an unbroken face of highlands 'directly in the course of rain-bringing winds of the Atlantic. Further,

* The names and drainage areas of the rivers in the second division from which salmon are excluded, together with the names of the districts in which they are situated, are given in the following table:—

District.	River.	Drainage Area in Square Miles.
Lossie, ...	Lossie, ...	147
Conon, ...	Conon, ...	148
,, ...	Orrin, ...	50
Ness, ...	Farigaig, ...	28
,, ...	Foyers, ...	98
Findhorn, . . .	Divie, ...	61
	Total, ...	532

The Amat Falls, on the Cassley, mentioned as impassable to salmon in the Board's Third Annual Report, have been opened up this year.

'these mountain masses present innumerable lochs and valleys directly 'in the course of these winds, up which the winds are borne, and, being 'cooled as they ascend, pour down those deluges of rain which deeply 'trench the sides of the mountains in the lines of their water-courses. 'The heaviest rainfall in this district is 128·50 inches in Glencroe, at the 'farmhouse situated immediately under the steep ascent to eastward, 'leading up to "Rest-and-be-thankful."' The map of the mean annual rainfall shows, he states, that the region of the heaviest rainfall, marked off by an average of 80 inches or upwards, annually, includes Skye and a large portion of the mainland to the south-east, as far as Luss on Loch Lomond. This region is surrounded by a region extending from the Crinan Canal northwards to Assynt in Sutherland, having a rainfall of 60 inches or upwards; while in no part of the third division is the rainfall marked off by an average of less than 40 inches or upwards. The fact of this heavy rainfall largely compensates for the small size of the catchment basins of most of the rivers. The only rivers on this long stretch of coast which have catchment basins to be compared with the rivers of the east coast are the Lochy and Spean, Awe, Dumbartonshire Leven, and Ewe. Of these the Dumbartonshire Leven is so given up to pollutions, from its exit from Loch Lomond to its entrance into the Clyde at Dumbarton, a distance of only 6 miles, as to leave no reasonable doubt that its salmon-producing capabilities are seriously injured. Although there are in this division only four principal rivers, yet there are no less than forty-one rivers having a drainage area of over 20 square miles respectively. These rivers drain a surface area of 3158 square miles. With the exception of the Dumbartonshire Leven and the Clyde, the fisheries are not injuriously affected by pollutions. The fact, however, of the water-parting which divides the catchment basins of the rivers flowing to the east from those flowing to the west, keeping close to the western shore, renders the majority steep and rapid, and in many cases salmon can ascend them for only a short distance. If the waters to which salmon have not access are left out it reduces the drainage area of this division to 2526 * square miles.

* The names and drainage areas of the rivers in the third division from which salmon are excluded, together with the name of the district in which they are situated, are given in the following table :—

District.	River.	Drainage Area in Square Miles.
Clyde and Leven,	Endrich,	42
,,	Falloch,	14
,,	Douglas Water,	10
Loch Fyne,	Kinglas,	11
,,	Aray,	12
Awe,	Avich,	12
,,	Etive,	38
Leven (Loch Linnhe),	Coe,	11
,,	Leven,	71
Lochy,	Spean,	205
,,	Kingairloch,	4
Aline,	Rannoch,	12
Morar,	Meoble,	11
Loch Luing,	Ling,	41
Balgay,	Balgay,	19
Badachro,	Badachro,	14
Broom,	Broom,	38
Kirkaig,	Kirkaig and Polly,	67
	Total,	632

The area closed by the Falls of Clyde is, of course, omitted, as the catchment basin of the Clyde is not included in the total drainage area of this division.

Description of the Fourth or South-Western Division.

The fourth division embraces the salmon fisheries from and including the district of the river Irvine to and including the district of the river Annan, the northern limit being Fairlie Head, while the eastern limit is the west bank of the river Sark in Dumfriesshire. The rivers of this division radiate westwards and southwards from the mountains of Ayrshire and Dumfriesshire, the water-parting being an undulating line drawn from Fairlie Head to the head of the Solway Firth. Over the whole division, Dr Buchan states there is not a single rain-gauge, even in the higher districts, whose annual average reaches 80 inches. He considers that :—'The partial drying of the south-westerly winds in their passage 'across Ireland, before they reach southern Scotland, explains this 'diminished rainfall.' An annual rainfall of 60 inches and upwards is experienced in the hills to the north of Galloway, where the Nith, the Ken, the Cree, the Doon, and the Girvan take their rise. A similar rainfall is met with in the Moffat Hills, where the catchment basin of the head waters of the Annan is situated. Over the other parts of this division there is a rainfall of 40 inches or upwards, with the exception of a small area lying to the eastward of Dumfries, where the average rainfall is from 30 to 40 inches.

There are seventeen rivers in this division having a drainage area of over 20 square miles. They drain an area of 2777 square miles, of which the greater part is within the catchment basins of the Nith, the Dee, the Annan, the Irvine, the Ayr, the Cree, the Bladenoch, the Stinchar, and the Doon. It would appear, however, from my predecessor's reports, that the Ayr and Irvine, although two of the largest rivers, are almost salmonless, owing to pollutions. The District Board of the river Nith also complain that that river is polluted below Dumfries by the town's sewage, and by dyes and scourings from woollen factories, dyeworks, and tanneries. If the catchment basins of the Irvine and Ayr are deducted, as well as those of waters to which salmon have not access on account of obstructions, the drainage area of this division open to salmon may be taken at 2140 square miles.*

Summary.

From the remarks which have been made it will be seen that, although the drainage areas of the rivers open to salmon in the first division may be estimated at 5203 square miles, in the second division at 5745 square miles, in the third division at 2526 square miles, and in the fourth division at 2140 square miles, yet the rainfall is so much greater in the divisions on the west coast than in those on the east coast, that such drainage areas alone do not indicate the relative size of the rivers in each division. Thus, for example, on the east coast, the river Ugie which drains one of the driest regions of Scotland, is spoken of as a small salmon river, whereas, on the west coast, rivers not having one-sixth of the drainage area of the Ugie, are frequented by salmon. It has already been remarked that to compute with accuracy the average volume of water discharged per square mile of drainage area would be complicated and difficult, and that, as the aim of the present discussion is to obtain general

* The names and drainage areas of the rivers in the third division from which salmon are excluded, together with the name of the district in which they are situated, are given in the following table :—

District.	River.	Drainage Area in Square Miles.
Cree, ...	Cree, ...	37
Nith, ...	Cluden Water, . . .	83
Girvan, ...	Water of Girvan, . .	13
	Total, ...	133

conclusions as to the extent of the salmon waters, such a calculation is unnecessary. In estimating the relative size of the rivers in each division it has, however, appeared to me desirable to obtain some general indication of the extent to which the rainfall influences the volume of water discharged from the drainage area. In order to obtain some such general indication I have calculated the approximate rainfall in each division. This calculation has been made by ascertaining the areas of the various rainfalls given in the map, and from these computing the average rainfall of the different divisions. The result arrived at is that in the first division the average rainfall is 41½ inches, in the second division 42, in the third division 70, and in the fourth division 51. Owing, however, to the small scale of the map of the mean annual rainfall on which these calculations were made, they can only be taken as approximate. Further, it should be mentioned that the amounts of rainfall on which this map is based, are, of course, taken at the mean level of the stations where they are observed. The actual amount, however, will be larger than this, in proportion as the mean height of the catchment basins exceed the mean height of the rain-gauges within their area. These data we have not yet before us, but they would be for this and many other questions a very valuable addition to our knowledge. If, however, this calculation is approximately correct, as it seems justifiable to conclude, it will then be possible to arrive generally at the relative extent of the fresh waters open to salmon in each division. It has been calculated than an inch of rain gives 2⅓ million cubic feet of water to the square mile.* For the purpose of comparison, therefore, it may be said that 502,089½ million cubic feet of water are discharged from the first division annually, 560,137½ million cubic feet from the second, 411,106½ million cubic feet from the third, and 252,520 million cubic feet from the fourth, or that, if the fresh waters of the first division are taken at 100, and the other divisions as proportional parts of the first, the second division represents 111, the third 82, and the fourth 50.

The basis on which fishery assessments are calculated is described in the Fishery Board's Report. From this explanation it can scarcely be doubted that there must be some relation between the assessed values of the fisheries and their productiveness. Such relationship may be subject to many qualifications. For instance, the assessed values might be influenced by the cost of getting the fish to market from remote and inaccessible districts, by the cost of fishing, by the season of the year at which the fish are taken, and by fish being caught by persons not having a legal right to fish. Such influences, amongst others, might reduce the assessable value of the fisheries in particular localities without indicating a corresponding decrease in the number of fish captured, but of their precise effect I am not yet in a position to speak with certainty. The only standard of the productiveness of the fisheries in each division is the number of boxes of salmon sent by rail and steamer, which was given in the Board's Eleventh Annual Report. This statement, however, as was pointed out, cannot be taken to represent the productiveness of the Scotch Salmon Fisheries, as it does not include salmon consumed in the neighbourhood where caught, nor single fish sent by rail. The coincidence, however, of the resemblance between the percentage of the number of boxes of salmon sent from each division and the assessed value of that division is worthy of note, and appears to indicate that the productiveness of the fisheries and the assessed values when taken over a wide area bear a close relationship to one another. It will be observed that in the case of the fourth division these percentages do not correspond, but the difference admits of explanation.

* Molesworth's *Pocket-Book of Engineering Formulæ*, p. 214.

Number of Division.	Drainage Area of Rivers.			Comparative Volume of Water discharged.		Length of Sea-board.	Assessed Value of Salmon Fishings.		Boxes of Salmon sent by Rail and Steamer.
	Total Area draining Catchment Basins of over 20 Sq. Miles.	Estimated Extent open to Salmon.	Estimated Average Rainfall.						
	Square Miles.	Square Miles.	Inches.	Millions of Cubic Feet.	* Percentage.	Miles.	£ s. d.	* Percentage.	* Percentage.
1.	6543	5203	41½	502,089½	100	150	51,263 8 10	100	100
2.	6277	5745	42	560,137½	111	280	33,522 11 0	65	57
3.	3158	2526	70	412,369½	82	350	11,796 3 11	23	23
4.	2777	2140	51	252,520	50	200	7,106 9 0	14	28

The above table shows that the value of the fisheries in the second, third, and fourth divisions is very much less than in that of the first division, indeed, that these divisions taken collectively only exceed by 2 % the value of the first division. It would appear that this decrease cannot be attributed to the extent of fresh waters open to salmon being greater in the first division than in the others, for, if the value of the fisheries were commensurate with the extent of fresh waters open to salmon, then the fisheries of the three last divisions should exceed that of the first by 143 %. Instead of this it will be seen that the values of the fisheries in the second division is 46 %, in the third, 59 %, and in the fourth, 36 % lower respectively than they should be if such values bore the same proportion to the extent of the fresh waters as the first division bears.

The lower values of the fisheries in the second, third, and fourth divisions are not due to the extent of sea board being less. Nor would it seem to be due to the facilities for fishing being greater in the first division. For if the facilities for fishing were greater in one division than in another, there can be little doubt that such greater facilities would be found to occur either inside or outside the estuary lines. This, however, is not so, except in the case of the fourth division, where the difference admits of explanation, for it will be seen that the value of the fisheries outside the estuary lines, in the first division, is 51 %, that of those inside, in the second division, 52 %, in the third, 42 %, and in the fourth, 27 %. The relative value of the fisheries, both inside and outside the estuary lines, corresponding so closely in the case of the first three divisions, shows clearly that the decrease in the second and third is general, and not confined to the fishings inside the estuaries, nor to those outside. This circumstance would appear to indicate that the lower values of the fisheries in these divisions are due to some conditions which affect the fisheries generally, and not to the facilities for fishing being less in one division than another.

Nor are these lower values due to salmon disease (*saprolegnia ferax*) being more virulent in the second and third divisions than in the first. Indeed, the very opposite is the case, as, with the exception of the Spey and Deveron, this disease appears to exist only in an epidemic form in the rivers of the first and fourth divisions.

Although the data at present available indicate that the comparative value of the fisheries in the second, third, and fourth divisions are very much less than those in the first division, and it appears that such lower values are not due to any of the conditions named, yet these data are too

* The figures for the first division are in each case taken as 100, and those for the other divisions as proportional parts of the first.

limited to admit of a general discussion of the probable conditions which have produced such results. As has already been observed, there are natural conditions which may enable the fresh waters in one division to support a greater quantity of fish life than those, of a similar extent, in another. Perhaps the most important natural distinction between these different divisions,—a distinction which probably influences to a certain extent the productiveness of the fisheries,—is that the rivers draining the first division are few in number but large, while those of the other divisions are, as a rule, small although more numerous. I venture, however, to submit that this information, as far it goes, while suggesting the very great possibilities which exist for the improvement of the salmon fisheries, shows very clearly the necessity of studying carefully the many conditions which are capable of human control, and which may cause the Acts to operate differently in different localities.

The first step towards such a study is to collect reliable statistics of the actual productiveness of the fisheries; the second, to ascertain in what numbers salmon seek the different rivers in each month of the year; the third to ascertain the proportion of male to female salmon taken in each month. It is well known that salmon seek some rivers in every month of the year. Other rivers, on the contrary, are short seasoned; that is to say, the principal run of salmon lasts only a few weeks, and that frequently during the fishing season. It is evident that in the latter case, at any rate, provision must be made to protect a larger number of fish during the fishing season than in the case of the former. It would seem, therefore, desirable that powers should be conferred on some authority to obtain statistical information with regard to these matters, and to vary the duration of the weekly close time in each district within certain limits.

Explanation of difference between assessed value and productiveness of fisheries in Fourth Division.

It has been said that in the fourth division the difference between the assessed value of the fisheries and their productiveness, as indicated by the number of boxes of salmon sent by rail and steamer, admits of explanation, and the same has been said of the low value of the fisheries outside the estuary lines compared with those inside. These differences are due to the special Acts regulating the salmon fisheries of the Solway Firth, which are the principal fisheries in this division. The first-mentioned difference is undoubtedly due in a great measure to the fact that, in the inner Solway, the fishings are prosecuted by whammel-net fishermen, licensed by the English authorities, who, although they take large numbers of fish which would help to augment the number of boxes of salmon sent by rail and steamer, yet, not being proprietors of salmon fisheries, the value of their fisheries would not appear on the valuation roll kept by the county and burgh assessors. The low value of the fisheries outside the estuary lines is due to the fact that, as regards the Solway, the ordinary method of fishing outside the estuary lines, viz., by fixed nets, is limited to such nets as were granted certificates of privilege by the Commissioners appointed in 1877 to enquire into the legality of fixed engines on the Scottish shores of the Solway.

Admitting, however, that the higher value shown by the average number of boxes of salmon sent by rail and steamer is a more approximate indication of the state of the fisheries in this division than their assessed value, yet, even in this case, the value of these fisheries falls very far short of those in the first division. Nor can it be said that this difference is due to the greater cost of getting fish to market, for the fisheries of this division are as well situated in this respect as those of the first division; nor yet to the expense of fishing, as the shallow and confined waters of the Solway Firth must offer every facility for the capture of fish at a small expense. Under these circumstances, it can

scarcely be doubted that such a difference must be due, to a certain extent, to the conflicting state of the laws in the Solway Firth, and the difficulties arising from it, to which attention has been repeatedly drawn in the Board's Reports, and which has, since 1870, formed the subject of four Special Commissions.

In answers to printed queries contained in Note k, it will seem that the Nith and the Annan District Boards desire to draw the attention of the Fishery Board to certain points with regard to this question. The Clerk of the Nith District Board states :—

'That amendment or consolidation of the different Acts of Parliament 'which now govern the Solway salmon fisheries is urgently required, and 'that in the direction of constituting a joint Board of Scotch and English 'representatives who shall administer the laws under one statute.'

And the following remarks are made by the Clerk of the Annan District Board :—

'I would suggest that the attention of the Board be drawn to the Acts 'applying to the Solway, the middle of which is the boundary between 'England and Scotland. In this district the fishing, with the exception of the 'weekly and annual close time, is regulated by the Annan Salmon Fisheries 'Act, 1841, which it is contended only extends in tidal waters to low-water-mark 'of spring tides. Between low-water-mark and mid-channel boundary line a 'great many fish for salmon, sea-trout, and grilse, with haaf and whammel-nets, 'without any permission, which is a great annoyance to the occupiers of the 'different fishings along the coast. The whammel-nets licensed by the 'English Authorities are being increased every year, each of the whammel-'boats having nets from 500 to 800 yards long. Thirty-four of these boats 'fished from Annan Waterfoot in 1893. This, in my opinion, is by far too 'many for the extent of the Solway, which is being overfished by them, doing 'a great deal of damage to the river fishings, and some steps should be taken to 'prevent these fishermen fishing without permission, and to regulate length of 'net allowed for each boat, which should not exceed 300 or 400 yards. By 'the English Act, no one can fish on the English side of mid-channel without 'a license. On English side of Solway both weekly and annual close time 'differ from that on the Scotch side, which encourages poaching. It would be 'a great advantage to the interests of the fishings if these close times were the 'same time. The whammel-net fishers referred to, have licenses from the 'Eden Fishery Board to fish on the English side of the Solway only. At a 'meeting of the Annan Fishery Board, held on the 20th December last, there 'was a discussion on the general question as affecting the salmon fishings of 'the Solway and the rivers flowing into it. And it appeared to be the unani-'mous opinion of the Board that, until a Bill is promoted in Parliament and 'passed, having for its object the repeal of all existing laws and their re-'enactment in more simple and intelligible form under the administration of a 'Joint Solway Fishing Board, no good results would follow, or harmony be 'expected to prevail among the many and conflicting interests involved.'

Influence of the exceptional characteristics of fisheries in the third division on the operation of the Acts.

It will be observed, from the description I have given of the leading characteristics of these divisions, that the third division, viz.,—that extending from Cape Wrath to Fairlie Head, presents the most marked individuality, and that it is in this division that the comparative value of the fisheries is lowest. It was in the southern half of this division, viz., from the district of the river Morar to that of the Clyde and Leven, that my inspections were principally made in 1893. The small rivers, the deeply indented coast, the numerous islands, and the great extent of confined tidal waters in this division, present an entirely different set of circumstances from those prevailing on the east coast, and I would beg leave to point out, as far as the information at my disposal will allow, the influence which these circumstances have had on the operation of the Salmon Fishery Acts.

It has been previously mentioned that one of the cardinal principles of salmon fishery legislation—a principle which seems to have been the aim of the more recent Salmon Fishery Acts of Great Britain and Ireland —has been to provide a free passage for the fish at all times from the sea to the head waters of the rivers. In my Report of the 29th Dec., 'On 'Crown Unchartered Inland Waters of Scotland,' appended to this Report and also in my last Annual Report, I have put forward evidence showing the importance of this principle, and I have also submitted that the great object to be kept in view, in order to carry it out, is to suppress netting in those places where fish congregate. In the reports referred to, I have further pointed out that such places are situated chiefly in confined fresh waters, more especially below obstructions. But it should, also, be observed that salmon congregate in estuaries at the mouths of rivers, as if unwilling to take at once to the fresh water. In large rivers, which pour down a fair flood of water at all times, this instinct is not so marked; but in smaller streams, such as the majority of those on the West Coast, this instinct causes the mouths of rivers to become as great an obstruction to the free passage of fish as mill-dams or cruive-dykes in larger rivers.

This instinct seems to have been recognised slightly in the Scotch Acts, and in a greater degree in the English and Irish Acts. By the Scotch Acts the most efficient instruments of capture, viz., fixed engines, are prohibited within the estuaries of rivers. By the English Salmon Fishery Act of 1873 (36 & 37 Vict. cap. 71, sect. 39, subs. 8) power is conferred on Boards of Conservators, each within their respective districts, to make a bye-law, subject to the confirmation of the Board of Trade, to prohibit the use of *all* nets within a certain distance of the mouth of any river (not being a several fishery), while the Irish Acts are still more restrictive in this respect, as the power to restrict netting at the mouth of any river is not left to the option of each local Board of Conservators, but is made obligatory by statute in the case of all narrow rivers (5 & 6 Vict. cap. 106, sect. 27; 13 & 14 Vict. cap. 88, sect. 44). Indeed, it seems, from the interpretation placed on sect. 44 of the latter Act, that the prohibition as to fishing within half a mile of the river's mouth applies to *any* river, and not only to rivers where the breadth of the mouth is less than a quarter of a mile.

The evidence advanced in the above-named reports not only shows that it is for the public interest that netting in confined waters where fish congregate should be suppressed, but that in those cases where they have been suppressed, and fishing in the fresh waters restricted to fair and legitimate angling for recreative purposes only, the results have been remunerative both to lower as well as upper proprietors. Since the issue of the Board's Eleventh Annual Report, in which the evidence on this subject is advanced, it is satisfactory to observe that steps have been taken by the proprietors on the river Tay, the largest river in Scotland, to combine for the purpose of suppressing some of the nets in fresh waters.

If the scheme which has recently been carried out on the river Tay were generally adopted, it could not fail in many ways to have a beneficial effect on the fisheries. At present a strong feeling exists that the various salmon fishing interests are opposed to one another. It is, naturally, extremely difficult for those who have the right of fishing for salmon in the sea, or on the lower parts of the rivers, to understand or believe that their interests can in any way be benefited by the observance of the weekly close time, or any other restrictions placed on fishing. It is scarcely a matter of surprise if many of them consider that the effect of such restrictions is simply to improve their neighbours' fishings a little higher up the rivers, and, as long as netting is allowed in confined waters, where fish congregate

for days and weeks, it would seem that they have good grounds for such a belief. If, however, such fisheries were suppressed, the object of restrictions could not fail in time to be better understood and appreciated ; the rivers would come to be considered as sanctuaries set apart for breeding fish ; the demand would gradually arise for systematic investigations, in order to determine how far restrictive regulations were beneficial, and what effect *similar* regulations had in *different* districts ; those prosecuting the fisheries would no longer consider that accurate statistics of the take of fish, and all other information which it is necessary to obtain in order to solve this complex and difficult problem was an inquisitorial and unwarrantable interference with the rights of property, but they would come to believe that such information was required for the purpose of enabling better steps to be taken for increasing the productiveness of the salmon fisheries.

Besides the small size of the rivers on the west coast, their situation, in most instances, at the head of long fjord-like inlets, and the numerous islands with which the coast is studded, are distinctive features of this division. These circumstances naturally result in there being an immense extent of inland waters which offer great opportunities for illegal fishing. These opportunities are further increased by the fact that no Boards have been formed in any of the fishery districts, with the exception of the Lochy, the Awe, the Torridon, and the Balgay. There are, therefore, no official means of enforcing the Salmon Fishery Acts, except in the districts just named, and in the districts in which the Duke of Sutherland and Earl of Cromartie are sole proprietors, and, therefore, may exercise all the rights of District Boards. Under these circumstances, it is scarcely a matter of surprise that complaints are made that in such districts the bye-law with reference to the weekly close time is frequently evaded by those fishing with fixed-nets in the sea. It would appear, also, that the evil arising from the want of official means to enforce the bye-laws does not stop there, for, where there are no Boards, there are no means of levying an assessment on the rentals or values of the fisheries. Thus no funds can be raised for their protection. The result is that not only are the bye-laws evaded by those having a right to fish, but illegal netting by means of small-meshed nets appears also to be prevalent among those not having such rights. Indeed, to such an extent does illegal fishing seem to prevail on some parts of the West Coast, that I was told by a person, who was in a position to know, that the number of fish caught by those not having a legal right to fish exceeded those caught by proprietors of salmon fisheries and their tenants. If this information is trustworthy, it must be most prejudicial to the interests of the salmon fisheries as a whole, as it would act prejudically in two ways. In the first place, those who break the law by fishing without a legal right, are not likely to respect the regulations contained in the Salmon Fishery Acts ; and in the second place, the power of enforcing the Salmon Fishery Acts diminishes at the same rate as illegal fishing increases. For, the greater the number of fish taken by those not having a legal right to fish, the lower the value of the fisheries liable to an assessment for their protection. Under these circumstances, it can hardly be wondered at that the values of the salmon fisheries in this division are so low.

The failure of the system of District Boards on the West Coast, my predecessor states, is due to the districts formed by the Commissioners appointed under the Salmon Fisheries (Scotland) Act of 1862 being much too small to maintain Boards. He states that he knows, from personal communication with one of the original Commissioners, that they would in many cases have been inclined to group together several of these smaller

rivers into one Fishery District, if they had not considered themselves bound, by the terms of the 6th section of the Salmon Fisheries (Scotland) Act of 1862, to assign a separate district to each river. He states in his Third Annual Report to the Board that :—

'If a number of small separate, but adjoining Districts, were grouped 'together into one large District, the assessments levied on the fishings belong-'ing to the combined District, including, of course, the sea-nets, would be 'sufficient to pay a District Board Clerk and a staff of watchers. Such a 'combined District, too, might be able to maintain a steam-launch, to see that 'bag-nets were not set or used within estuary lines ; that the weekly close time 'was duly observed by them ; and that poaching for salmon and sea-trout by 'unqualified fishermen, or, as it is locally termed, "scringing," in the sea lochs 'and off the mouths of rivers was prevented or punished.'

A remedy, however, for this state of things, although so urgently needed, has not yet been provided. Indeed, at present, as regards many of these districts, the Salmon Fishery Acts of 1862 and 1868 might as well not exist. I met with some proprietors of salmon fisheries who were not aware that they did exist. The statement of the assessed values of the salmon fisheries, furnished by the county and burgh assessors, shows that if all the salmon fisheries in this division were assessed, even at a rate below that at which some Boards assess the salmon fisheries in their districts, the amount realised would be sufficient to provide for the payment of a staff and the maintenance of steam-launches to see that the Salmon Fishery Acts were enforced along the whole of this part of the coast, and leave a considerable margin for the protection of the fresh waters.

Protection of fish at spawning time.

I have dwelt at some length on the importance of providing for the free passage of fish from the sea to the head waters of the rivers at all times. There is, however, a principle of even greater importance, with regard to which the Salmon Fishery Acts have not proved wholly successful, viz. :— the protection of fish at spawning time. It is quite clear that it is useless to provide for the free passage of fish at *all* times, or at *any* time, if they are not protected during the annual close time. My predecessor has frequently drawn attention to the inadequacy of the 21st section of the Salmon Fishery (Scotland) Act, 1868 (31 & 32 Vict. cap. 123) for the prevention of the sale of salmon caught during the extension of the time for rod-fishing, and to the necessity for providing more efficient means of checking illicit traffic in salmon. The result of the decisions * seems to make it impossible to obtain a conviction for the illegal buying, selling, or exposing for sale of salmon, except between the 30th November and the 10th January, unless it can be proved *when*, *where*, and *how* the fish were caught.

It is hardly necessary to point out what a temptation such a state of the law offers for the destruction of salmon during the annual close time. Hitherto no remedy has been provided. I venture, therefore, to keep it before the Board as one of the first requirements in any fresh salmon fishery legislation.

I have the honour to be,
Your obedient Servant,
WALTER E. ARCHER.

THE FISHERY BOARD FOR SCOTLAND,
1*st May* 1894.

* Blair *v.* Shepherd, 7th April 1871 ; Chalmers *v.* Bain, 1889 ; and a case tried before Lord Young at Dumfries on the 22nd Dec. 1892.

NOTE I.

THE FOLLOWING QUERIES HAVE BEEN SENT TO CLERKS OF DISTRICT BOARDS:—

Take of Fish—

1. Has the take of fish in your district in 1893 been above, about, or below the average.
   (*a*) In tidal waters?
   (*b*) In fresh waters?
   (*c*) In fixed engines?
   (*d*) Generally throughout the district?

2. Can you give the number of fish caught in your district, exactly or approximately?
   (*a*) By net and coble?
   (*b*) By fixed engines?
   (*c*) By rods?

3. At what period of the year in your district during 1893—
   (*a*) Were the first clean fish taken?
   (*b*) When was the main take of salmon?
   (*c*) When did the grilse and sea-trout run?

4. In order that accurate records be kept as to whether the run of salmon in your district is becoming earlier or later, it is desirable that you should, if possible, obtain and furnish me with statistics of the percentage of fish taken in each month—
   (*a*) By net and coble?
   (*b*) By fixed engines?

5. What was the weight of the heaviest salmon or trout caught in your district in 1893—
   (*a*) By net and coble?
   (*b*) By fixed engines?
   (*c*) By rods?

Protection—

1. Was any alteration made in the assessable rental of your district in 1893 from the previous year? If so please state the amount.
2. What was the assessment levied thereon during this year?
3. State the number of water bailiffs employed in your district in 1893?
4. Were any prosecutions instituted under the Salmon Fishery Acts in 1893? If so, for what offences were they instituted and what was the result?

Obstructions to the Passage of Fish—

1. Give full particulars of any dams destroyed or given up in your district in 1893; or any new dams built or old dams altered?
2. Have any cruives in your district not been fished during 1893?
3. Are the dams and cruives in your district worked in accordance with the provisions of the byelaws (Schedule F and G) regulating the same?
4. Have any fish passes been built or altered in 1893?
5. Do the existing fish passes afford at all, at any, or at what times a free passage to Salmon wishing to ascend?

6. Have any natural obstructions been opened up during 1893?
7. Generally have any acts been done either by new fisheries being started, old fisheries not being used, or in any other way whereby the ascent of fish has been influenced? If so, state fully what changes have taken place.

Pollutions—

1. Were there any fresh causes of river pollution introduced in your district in 1893?
2. Were any steps taken in 1893 to remove causes of pollutions; and if so were they attended with success?

The Salmon Disease—

1. Has the salmon disease shown itself in your district this year? If so, when did it first make its appearance? When was it at its height? When did it disappear?
2. What was the level of the river during the prevalence of the salmon disease?
3. Can you state the number of diseased salmon taken from the river in each month, specifying what proportion was male and what female, what kelts, and what clean fish?
4. Generally, have you any remarks or suggestions to make with regard to the salmon disease?

The Spawning Season—

1. What was the earliest date, during the season of 1892–1893, on which salmon were noticed spawning?
2. Between what dates did the greatest number spawn?
3. When did the spawning season finish?
4. What was the level of the river during the spawning season?
5. Were the numbers of spawning fish more or less than usual?
6. Which are the principal spawning streams in your district?

Kelts—

1. On what date, during last season, were kelts first noticed migrating seawards?
2. When did the chief migration take place?
3. When was the river free from kelts?
4. What was the level of the river during the period kelts were migrating?

Smolts—

1. On which dates, during the year, were smolts noticed migrating?
2. Was it a good smolt year?

Artificial Propagation of Salmon—

Is there any hatchery in your district for the artificial propagation of salmon and trout, either belonging to the district board or supported by private enterprise? If so, describe its situation, and state how many fish can be hatched out in it annually.

Proportion of Male to Female Salmon—

Can you state the proportion of the male to the female salmon in your district or river, specifying whether your return, so far as it goes, is based upon an estimate or on actual enumeration?

Marking Salmon—

Have any observations been made in your district on the migration, growth &c. of salmon by means of marking them? If so, please state where details are recorded.

Temperature of Water—

Have any observations been made in your district on the temperature of river water?

Fluctuations in the River Level—
Do you base your observations as regards the level of the river on records obtained by means of a standard gauge or by general terms such as 'flood,' 'half-flood,' or 'low'?

Wild Birds' Protection Act, 1880—
Do you think that the 'Wild Birds' Protection Act,' 1880, which preserves a variety of birds—specified in the schedule attached to the Act—which destroy salmon and trout ova and fry, should be repealed as regards Scotland?

General Question—
Are there any other points relating to the salmon fisheries in your district to which you would wish to direct the attention of the Board, in addition to those suggested by the preceding queries?

ANSWERS TO THE FOREGOING QUESTIONS.

In those cases where the answer to any of the above questions consists of a simple negative, it has been omitted from the following return.

THE DISTRICT OF THE RIVER TAY.

Take of Fish—
1. (*a*), (*b*), (*c*), (*d*), below.
3. (*a*) The 11th of February, when the season opened; (*b*) July; (*c*) End of May.
5. (*a*) 56 lbs.

Protection—
4. The offences were chiefly in close time for taking salmon.

Obstructions to the Passage of Fish—
3. Yes.
5. None; they have been of no use hitherto as no fish have reached them
7. None, but arrangements are in progress for taking off the nets above the Linn of Campsie.

The Salmon Disease—
1. About the middle of October and was at its height in January and disappeared with the last of the Kelts in May.
2. The river was in normal size.
3. 634 diseased—5 males to 3 female, about half-a-dozen clean fish diseased.
4. It seems to be decreasing in this district.

The Spawning Season—
1. The 4th of October.
2. From the 10th November to the 10th of January.
3. End of January.
4. Normal.
5. Can't tell. Seemed average.
6. Tay, Earn, Isla, Ericht and Garry.

Kelts—
1. From the New Year onwards.
2. In April.

3. End of May.
4. Very small and low.

Smolts—
1. Towards end of May.
2. Fairly.

Artificial Propagation of Salmon—
Dupplin.

THE DISTRICT OF THE RIVER SOUTH ESK.

Take of Fish—
1. (*a*), (*b*), (*c*), (*d*), Generally been below the average in numbers but about the same in weight or size.
2. (*a*) about 3000; (*b*) about 25,000 ; (*c*) about 400.
3. (*a*) The 16th of February : (*b*) May and June 1893 (considered uncommonly early) ; (*c*) July.
5. (*a*) 24 lbs ; (*b*) 48 ; (*c*) 37 lbs.

Protection—
2. Eight per cent on rental. Amount of assessment on rental, viz., £240, 19s. 2d.
3. 1 superintendent and 7 bailiffs.
4. Five prosecutious instituted—offences chiefly fishing in close time, and using illegal instruments or drags. One party prosecuted for possessing unclean fish, seized at Railway Station. In all the cases, offenders convicted and fined.

Obstructions to the Passage of Fish—
2. No cruives in district.
3. Dams worked in accordance with bye-laws.
5. Fairly good.

The Salmon Disease—
1. Disease to small extent appeared in September 1893. At height in November. Exists still, but to a small extent.
2. Low.
3. 107 diseased fish removed—largest number in December 1893, mostly kelts, 2 males to 1 female of diseased fish. Only 2 clean fish found diseased.
4. Disease appears to disappear after the spawning season is over.

The Spawning Season—
1. The 8th November 1892.
2. Between December 1892 and January 1893.
3. End of January 1893.
4. Generally low—from 8 to 12 inches over the summer size
5. Considerably more.
6. At Kinnaird and Tannadice, parts of the river South Esk.

Kelts—
1. The 14th February 1893.
2. The middle of March.
3. The beginning of April.
4. 12 inches above the ordinary size.

Smolts—
1. The 31st of March 1893.
2. Fairly good.

Proportion of Male to Female Salmon—

From the dead fish taken out of river, consider that there are 2 males to every female fish in the river.

Fluctuation in the River Level—
General terms.

DISTRICT OF THE RIVER DEE.

Take of Fish—
1. (*a*) Below average ; (*b*) Rod fishing, a good average season ; (*c*), (*d*), Below average.
2. No information. As stated in previous years it would be impossible without direct communication with fishing proprietors and tenants to give number even approximately. Fishers, especially net, will give no information.
3. (*a*) At opening of fishing season, viz., the 11th of February ; (*b*) taking district all over, April. Main takes on coast and tidal waters in the middle of July ; (*c*) First grilse taken on the coast on the 2nd of May ; in the river on the 23rd of May.
4. Impossible to furnish statistics of monthly takes, they depend on weather, tides, winds, &c.
5. (*a*) 35 lbs. salmon at Midchinge—tidal water ; (*b*) 49 lbs. salmon at Cowie —sea ; (*c*) 34 lbs. salmon at Ballater.

Protection—
1. Rental, 26th August 1891 to 26th August 1892, £12,336. Rental, 26th August 1892 to 31st July 1893, £13,911.
2. 1891-92, at 7 per cent. 1892-93, at 8 per cent.
3. In close season, 26 and inspector ; in open season, 4 and inspector. This includes men on steam launch, viz., 6 men and firemen in close time.
4. One complaint under section 17 of 1868 Act, two men involved, 1 convicted, 1 not proven. Eight complaints under section 20 of 1868 Act, 13 men involved—12 convicted, 1 not proven. One complaint under section 27 of 1862 Act, 1 man involved and convicted, *i.e.*, 10 cases—16 men involved and 14 convicted.

Obstructions to the Passage of Fish—
1, 2, 3, 4, 5, no dams or cruives in the district and no passes.

The Salmon Disease—
1. No disease since January 1893. Very hard frost before that time and on ice then breaking up with flood, large number of diseased fish killed. No disease since then.
2. River has run very heavy since August. Prior to that much lower than usual.

The Spawning Season—
1. The 17th of October 1893.
2. Month from the 17th October, on upper reaches. End of December and beginning of January on lower reaches.
3. It finishes end of February ; odd fish on beds to middle of March.
4. Very low in October 1892 to January 1893. But full, October 1893 to January 1894.
5. 1892-93, above average. 1893-94, average.
6. Gairn, Cluny, Callater, Geldie, Feugh and other tributaries and river at Aboyne and Ballater.

Kelts—
1. About 1st December.
2. February 1893.
3. Never. But most of them out by July.
4. When river full, Kelts are swept down.

Smolts—
1. April and May.
2. Above average.

Artificial Propagation of Salmon—
There are two hatcheries; one in the Aberdeen Salmon Co.'s premises in Aberdeen, belonging to Dee and Don Boards jointly, which should hatch from 12,000 to 20,000 yearly; and another belonging to the Dee Board at Drum which should hatch from 900,000 to 1,000,000 fry. The hatchery at Drum is new and last year was not filled. It is not yet filled this winter, but is expected to turn out 900,000.

Proportion of Male to Female Salmon—
No information. In getting ova for hatching at the beginning of the close season from the upper reaches of the River and tributaries, it is found that much the greater proportion of fish on redds are males. But in fishing deeper pools nearly all the fish got are female. The male fish are on redds first. Taking it all over as far as seen the proportion is equal.

Fluctuation in the River Level—
No standard gauge used; general terms used.

Wild Birds' Protection Act, 1890—
There seems no necessity.

DISTRICT OF THE RIVER DON.

Take of Fish—
1. (*a*), (*b*), (*c*), (*d*). all below average, except sea fishing (fixed engines) at mouth of Don where large takes at close of net fishing brought that particular fishing up to average.
2. No information. As stated in previous years it would be impossible without direct communication with fishing proprietors and tenants to give number even approximately. Fishers, especially net, will not readily give information.
3. (*a*) At the opening of season, 11th February; (*b*) about the beginning of August at mouth of River; (*c*) grilse at end of April; sea trout are running at opening of season.
4. Impossible to furnish statistics of monthly takes. They are late or early in season according to weather, tides, etc.
5. (*a*) About 40 lbs. salmon not weighed; (*b*) 50 lbs salmon in bag net at Nether Don; (*c*) salmon about 40 lbs. not weighed, at Cruives.

Protection—
1. Rental 26th August 1891 to 26th August 1892—£3622. Rental, 26th August 1892 to 31st July 1893—£3963.
2. Assessment both years at 20 per cent.
3. In close time, 16 and inspector. In open season number vary from 6 to 2 and inspector.
4. 10 complaints under Section 20 of 1868 Act; 20 men involved altogether; 16 convicted, 3 not proven, 1 could not be found to get service made. 4 complaints under Section 17 of 1868 Act, 5 men involved, all convicted. 1 complaint under Section 3 of 9 George IV. c. 39, 2 men involved, both convicted, *i.e.* 15 complaints against 27 men of whom 23 were convicted.

Obstructions to the Passage of Fish.
1. No dams destroyed or given up or new ones built. At Mugiemoss damdyke the pass shortened from 31 yards to 17.
2. The cruives were fished as usual.
3. Yes.

4. Yes. See answer to No. 1 above.
5. The passes may be said to be right enough when there is sufficient water in the river. But so much is taken out by lades that nearly all the summer the passesare practically useless.

Pollutions—
The town council have at present a scheme under consideration for carrying all sewage from Buxburn, Woodside, and Old Aberdeen direct to sea, and plans are being prepared. The clerk has had long correspondence with millowners as to pollution, and if things are not improved they are not allowed to get worse.

The Salmon Disease—
1. After close of season 1892, 300 diseased salmon taken out of the river between Stoneywood and mouth of the river (8 miles) between 31st October 1892 and January 1893. Practically no disease since then. River never so clear of disease as now. Only 2 diseased salmon seen this fall, at the beginning of December.
2. Low water at the end of 1892 when disease bad.
3. No information. Most taken out in October 1892. Greater number perhaps were females. Majority kelts not clean fish.

The Spawning Season—
1. Seen on spawning beds end of October 1892, and in 1893 on the 1st of November.
2. December and beginning of January.
3. End of January, but odd fish on beds till end of February.
4. Fairly full in January 1893, better just now, 1894.
5. Above average last season, *i.e.* December 1892 and January 1893. Less this season, *i.e.* December 1893 and January 1894.
6. River itself at Breda and Kildrummy.

Kelts—
1. About end of December 1893.
2. End of April.
3. Never. They come down to Grandholm dyke and cannot get over unless big flood comes.
4. Kelts naturally come down in greater numbers when river is full.

Smolts—
1. Greatest number in May, but they migrate before that—a few as early as March.
2. Average.

Artificial Propagation of Salmon—
One hatchery in Aberdeen Salmon Co.'s premises in Aberdeen belonging jointly to the Don and Dee Boards. It should hatch from 12,000 to 20,000 fry yearly.

Fluctuations in the River Level—
No standard gauge. General terms used.

Wild Birds' Protection Act, 1880—
No apparent necessity.

DISTRICT OF THE RIVER YTHAN.

Take of Fish—
1. (*a*) About the average; (*b*) Below the average; (*c*) About the average; (*d*) About the average.
2. (*a*) and (*b*) The Lessees refuse to supply this information; (*c*) about 90.
3. (*a*) On the 25th of February; (*b*) April; (*c*) August.
4. See answers to No. 2 *a* and *b*.
5. (*b*) 51½ lbs; (*c*) 32 lbs.

Protection—
1. There has been no alteration made in the assessable rental.
2. £124, 15s. 6d. being a little over 2s. 5¾d. per £1.
3. One all the year round and four additional from November to March.
4. A box of unseasonable salmon was seized, condemned, and sold. The consigner could not be found and it was not claimed.

Obstructions to the Passage of Fish—
2. We have no cruives.
5. Yes.
6. There can hardly be said to be any.

Pollutions—
2. The pollution arising from the drainage of the village of Ellon, is under the notice of the Board, and when a new drainage scheme is prepared will again be considered.

Salmon Disease—
1. Yes.
2. The river was very low.
3. The number for each month cannot be given; 157 males, 29 females, mostly kelts.

The Spawning Season—
1. About first week of December 1892.
2. From 1st to 31st January.
3. About the middle of February.
4. The river was pretty high.
5. About the same as usual.
6. Ebrie, Bronie, Little Water, Fordoun and Ythan.

Kelts—
3. About the end of June.
4. Very low.

Smolts—
1. Cannot be accurately answered.
2. Very good.

Proportion of Male to Female Salmon—
About 6 males to 4 females.

Fluctuations in the River Level—
By General terms.

DISTRICT OF THE RIVER UGIE.

Take of Fish—
1. The take of fish has been below the average generally through the district.
2. Number of fish caught approximately is as follows :—
(*a*) 3000 sea-trout; (*b*) 2300 salmon and grilse; (*c*) 40 grilse, 5 salmon and 600 sea-trout.
3. (*a*) 15th March; (*b*) Between the middle of August and the 9th of September; (*c*) mostly in September.
4. I cannot give the percentage of fish taken monthly, but I give the following taken by Messrs West & Strachan, Salmon fishers on the River Ugie, March, 5; April, 26; May, 30; June, 68; July, 153; August, 252; and September, 168.
5. (*b*) 45 lbs. salmon; (*c*) 22 lbs. salmon, 6 lbs. trout.

Protection—
1. Yes. Assessable rental in 1892, £357, 16s. Assessable rental in 1893, £356. 10s.
2. 1s. 5·870d. per £1.
3. Six.

Obstructions to the Passage of Fish—
1. No dams have been destroyed or given up and no alterations have been made on existing dams. In fact there have been no alterations on fish passes at all. The dam at the intake at Ravenscraig was considerably improved more than a year ago.
2. Cruives, unless for the purpose of catching salmon for breeding purposes, are not fished.
3. I believe so.
5. I believe so.
6. Not so far as known to me.

Pollutions—
1. I believe not, but causes of pollution still exist.
2. The removal of a cause of pollution, arising from waste matter, flowing from a woollen manufactuary at Millbreck is at present under consideration.

The Salmon Disease—
1. Yes, the disease first appeared on the 11th of January. It was at its height in April, and disappeared in May.
2. Low.
3. January, 2 males; February, 2 males and 1 female; March, 9 males and 17 females; April, 18 males and 23 females; May, 7 males and 8 females. All were kelts.

The Spawning Season—
1. The 23rd of December 1892.
2. The 28th December 1892, and the 14th January 1893.
3. The middle of January 1893.
4. Half-flood.
5. More than usual.
6. The North Ugie.

Kelts—
2. During March.
3. The end of May.
4. Half flood.

Smolts—
1. Between the middle of April and end of May.
2. It was an average smolt year.

Artificial Propagation of Salmon—
There is a small hatchery supported by private enterprise and about 70,000 are hatched annually.

Proportion of Male to Female Salmon—
I am unable to ascertain.

Temperature of Water—
I have conducted these observations for a number of years, and believe the results for a considerable time have been tabulated by the Scottish Meteorological Society.

Fluctuation in the River Level—
By 'flood,' 'half-flood,' and 'low.'

Wild Birds' Protection Act, 1880—
It should be repealed as far as the tarrock and merganser are concerned.

DISTRICT OF THE RIVER DEVERON.

Take of Fish—
1. (*d*) About an average fishing.
3. (*a*) The 11th of February; (*b*) fresh water, February and March, sea, August; (*c*) July.
4. (*a*) February, 36 per cent.; March, 26 per cent.; April, 3½ per cent.; May, 2 per cent.; June, 2½ per cent.; July, 6½ per cent.; August, 23½ per cent. This applies only to salmon.
5. (*a*) 50 lbs.; (*b*) 48 lbs.; (*c*) 37½ lbs.

Protection—
1. Raised from 2s. 9d. or £284, 19s. 4½d.
2. 2s. 11d. per £ or £311, 14s. 4½d.
3. Nine.

Obstructions to the Passage of Fish—
3. Yes.
5. Always when water low.

Pollution—
1 2. Yes, the Isla has been complained of, and forms the subject of discussion between the County Council and the Local authorities, through whose district it flows.

The Salmon Disease—
1. Yes; January, April, May.
2. Low.
3. January, males 92, females 4; February, males 196, females 24; March, males 384, females 104; April, males 136, females 668; May, males 0, females 36. Ouly 3 clean fish.

The Spawning Season—
1. October 16th 1892.
2. Between 1st November and 31st December.
3. 1st April 1893.
4. 'Half-flood' and 'low' in end of December.
5. Above the average.
6. Spawning beds are pretty well distributed over the whole river.

Kelts—
1. From December.
2. In months of April and May.
3. In August.
4. Low, generally.

Smolts—
1. On 15th April and 6th May.
2. Fair.

Artificial Propagation of Salmon—
Yes, supported privately. On left bank of Deveron about 1½ miles from the sea, 100,000.

Proportion of Male to Female Salmon—
4 females to one male. By actual enumeration. In river alone. Fluctuation in River Level. 'Flood,' 'half-flood,' or 'low.'

Wild Birds' Protection Act, 1880—
Yes.

DISTRICT OF THE RIVER SPEY.

Take of Fish—
3. (*a*) The 11th of February; (*b*) (*c*) Sea-trout during whole season, grilse about July and August.
5. (*a*), (*b*) About 50 lbs. salmon; (*c*) About 42 lbs.

Protection—
1. Assessable rental for 1893-94, £9381.
2. Assessment for 1839-94, 2s. 8d. per £.
3. See Report.
4. See Report.

The Salmon Disease—
1. See Report.
2. Various.
3. See Report.
4. See Report.

The Spawning Season—
1. The 26th of September 1892.
2. The 1st of November 1892 and the 31st of January 1893.
3. 1st of May 1893.
4. Various.
5. See Report.
6. See Report.

Kelts—
3. About the end of June.
4. Various.

Smolts—
1. About second week of April.
2. Very good.

Artificial Propagation of Salmon—
Yes, at Fochabers, supported entirely at the expense of the Duke of Richmond and Gordon. Nearly half-a-million can be hatched annually.

Proportion of Male to Female Salmon—
See Report.

The following is a copy of the Superintendent's Annual Report, for year ending 26th August 1893, submitted to the meeting of the Spey District Board, held in Elgin on the 20th October 1893:—

I.—*Salmon Spawning.*

The following Tables show the dates of the first appearance of salmon spawning beds, the number seen and counted by the bailiffs during the last two spawning seasons of 1891-92 and 1892-93 on the following named streams or tributaries:—

1891–92.

Name of Stream.	Spawning Commenced.	No. of Beds for Season.
Fiddich - - -	5th October 1891	933
Avon - - - -	20th „	1040
Livet - - - -	8th „	275
Conglass - - -	10th „	135
Lochy - - -	12th „	21
Dulnain - - -	12th „	767
Nethy - - -	17th „	264
Druie - - -	12th „	292
Feshie - - -	13th „	544
Tromie - - -	20th „	109
Truim - - -	13th „	82
Spey (above Laggan, Badenoch)	9th „	129
Total - - -		4591 Spawning Beds.

1892–93.

Name of Stream.	Spawning Commenced.	No. of Beds for Season.
Fiddich - - -	26th September 1892	548
Avon - - -	19th October	1440
Livet - - -	19th „	432
Conglass - - -	17th „	196
Lochy - - -	18th „	97
Dulnain - -	17th „	694
Nethy - - -	20th „	274
Druie - - -	17th „	424
Feshie - - -	17th „	728
Tromie - - -	20th „	123
Truim - - -	10th „	83
Spey (above Laggan, Badenoch)	6th „	104
Tulchan Burn - -	20th „	132
Aberlour Burn - -	December 1892	12
Total - - -		5287 Spawning Beds.
Increase in Spawning Beds from last year's number		696 „

In my last year's Report respecting the spawning season of 1891–92, I had to describe it as that of the best spawning season on the Spey district that had taken place since that of the season of 1888–89. Last season, 1892–93, has, however, surpassed the preceding season by an increase of 696 spawning beds counted over the tributaries, thus showing only 350 spawning beds behind that of the standing record of the 1888–89 season. If we go by actual spawning over the district, there is no doubt but that last season's spawning was far above that of 1888–89, in so far as during the months of January and February on the river Spey, between Boat o' Brig and Grantown, the spawning fish were literally swarming, and although it is impossible to count spawning beds with accuracy within the river owing to its large size, from the appearance of the large number of fish, together with the appearance of spawning beds, 1892–93 season far surpassed that of 1888–89. To enumerate and exemplify the increase and decrease of spawning beds counted upon the respective tributaries last season, comparing the same with the preceding one of 1891–92, is somewhat startling and interesting, seeing that there was a large increase on the total tributaries for last season. The more manifest feature in this point is the large decrease on the usually fine spawning tributary of Fiddich, showing a decrease of nearly 400 beds against the previous year's redds, and a decrease of 790 beds compared with the season of 1888–89. The natural question arises at once—Why this great decrease on Fiddich? I can give no reason for this great fluctuation, further than to say that, when the rush of spawning fish ascended the Spey to the spawning grounds during October, very few of them found their way into the Fiddich. The increase of 696 spawning beds for last season is made up upon the tributaries as follows, comparing the said season with the previous season of 1891–92:—Fiddich,

decrease 385 beds; Avon, increase 400 beds; Livet, increase 157 beds; Conglass, increase 61 beds; Lochy, increase 76 beds; Dulnain, decrease 73 beds; Nethy, increase 10 beds; Druie, increase 132 beds; Feshie, increase 184 beds; Tromie, increase 14 beds; Truim, increase 1 bed; Spey (above Laggan, Badenoch), decrease 25 beds; Tulchan and Aberlour Burns, 144 beds extra for the season. Damage to spawning beds by floods and ice was of trifling account during last season. The low state of the Spey during the months of May and June would, and I have no doubt has, caused destruction to no small amount of salmon ova deposited on the thin or shallow spawning fords in the river. In consequence of the dry weather the spawning redds were left high and dry, and consequently exposed to a burning sun, causing death among the propagating and propagated ova thus exposed. The spawning on the river Spey, between Boat o' Brig and Grantown, and upon the Fiddich and Avon, continued up till month of March.

II.—*Smolt Season.*

During last season descending smolts were seen to be more numerous than that seen for many seasons back. Shoals of the silvery fry were seen descending the river Spey seaward about the middle of April, this being about a month earlier than descending smolts are usually to be seen in large quantities in the district, but the fact was evidently caused by the unusual mild and genial open weather experienced during last spring. From this time up till middle of June the smolt and salmon fry watchers and bailiffs, eight in number, and stationed all over the district of the Spey and tributaries from Speymouth to Boat of Garten, reported that the appearance of smolts was the best during last season that they had ever seen. Notwithstanding the extra fine appearance of smolts seen descending the river during the spring and early summer, the show of grilse in the river and all along the sea coast over the Spey district has been rather poor, and under an average compared with previous seasons. Twelve dozen of printed notices cautioning persons against taking or killing smolts or salmon fry were posted up at conspicuous places along the sides of the river and tributaries over the whole district. At end of the smolt watching season, 10th June, the Superintendent, Inspector, and two Constables continued to protect the parr or salmon fry, and on 31st July this force was augmented by other three men to protect the salmon-fry. This force was strengthened by other members at end of August, and continued on duty until the close of the rod and line fishing. The same mode of cautioning persons once and taking down their names and addresses, as cautioned against killing parr or salmon fry, has been continued this season. The number of persons so warned and shown parr by the bailiffs during the spring and summer of 1891 was 500. The number for last year was 385, and for the present summer the number amounts to 237 persons warned and shown parr and not previously warned.

III.—*Disease among Fish.*

About the usual amount of fungoid disease was observable among the la spawning fish over the district during last spring. I, as formerly, took no of the disease among the fish spawning on the Fiddich, giving the percentage of fish dying from the disease to the number of spawning beds counted upon the same stream during the season. The percentage of such for season 1889-90 was 13 per cent.; for season 1890-91, 18 per cent.; for season 1891-92, 16 per cent. Last season the number of spawning beds counted was 548, and the number of dead and diseased fish removed and buried was 103, thus making the deaths 19 per cent. No excess in males over females was observable in this stream during the spawning season, yet the diseased quota regarding sex stood as follows:—Males 97, females 6.

On the 14th December last the Spey Board Clerks sent me a circular paper issued from Fishery Board for Scotland Office at Edinburgh, bearing upon a new disease observed to have attacked smolts on the river Bann in Ireland. The disease is described as appearing in the shape of small ulcers showing themselves on the external or outer surface of the smolt, the ulcers varying in

size from a pin's head to that of a sixpence. No appearance of such a disease has been seen in this district. During the first week of May, Chas. Meldrum, the smolt watcher bailiff, then on the Rothes district of Spey, reported to me that he had observed on two occasions during that week, in the Spey near Rothes, a dead smolt coated with fungoid and a dying one coated with the same disease. On each fry the extent of the coating was as large as a shilling piece. At this time the weather was exceedingly warm and the river low, and it is quite possible that the disease seen upon those two fry may have been caused by their having been previously "foul hooked" by a trout angler and thrown back to the river. The wounds thus caused would very readily become fungoid.

IV.—*Poaching during the Year.*

There were five prosecutions for contravention of the Salmon Acts, and convictions were obtained in all except in one for alleged breach of the weekly close time, which, after evidence had been led, was found not proven. Three boys of 13 years of age were admonished for taking salmon fry.

V.—*Bye-Laws.*

As to the Bye-Laws relating to Dam Dykes, Mill-lades, Sluices, Hecks, &c., these were all properly attended to during the year over the whole district. During the coming season, through the kindness of His Grace the Duke of Richmond and Gordon, iron hecks of a proper and substantial nature are to be put into the lades at the meal mills of Tombreachie and Auchreachan, as also a new sluice on the Crombie, on the intake of the threshing mill-lade of the farm of Tulloch, Glenlivet.

General Remarks.

The sea coast and river salmon net fishing opened on 11th February and closed on 26th August. With the exception of the one case referred to in Section IV. of this report, the observation of and attention given to the carrying out of the weekly close time over the whole district during the season was quite satisfactory, and no other breach of a like nature was observed by either myself or the Inspector during our frequent visits to the coast to require of further reporting.

An extensive and high-class hatchery for the propagation of salmon has been erected by His Grace the Duke of Richmond and Gordon on the right bank of the river Spey near the village of Fochabers. During last autumn and winter a total of nearly half-a-million salmon ova were deposited in this hatchery and successfully hatched and attended to until they were matured to such a stage as permitted of their being removed from the hatchery and deposited in the river. The operations were under the management of Mr John Rae, overseer of the salmon fishings at Tugnet, Fochabers. Some 40,000 of the ova thus hatched at Fochabers were procured from early spawning fish on Fiddich last autumn, the others being secured from the river Spey in the Fochaber or Orton district. If only one half of the fry which were thus cast adrift from the hatchery during the month of May last were to reach the stage of grilse and salmon and remain within the Spey district of sea and rivers, the number would give no scarcity of fish over the district for some time to come. I had the pleasure of visiting and seeing the fry in all their different stages in the hatchery at Fochabers.

The full force of Bailiffs or Spey Police is constituted as follows:—The Superintendent, stationed at Aberlour; the Inspector, stationed at Grantown; eight Sergeants, and thirty-six Constables.

GEORGE K. MACGREGOR, *Superintendent.*

DISTRICT OF THE RIVER FINDHORN.

Take of Fish—
1. (*a*) About an average; (*b*) below an average; (*c*) about an average; (*d*) about an average.
3. (*a*) The 11th of February; (*b*) April and May; (*c*) Grilse, May; trout, June; sea-trout may be got throughout the season.
5. (*a*) 40 lbs.; (*b*) 38 lbs.; (*c*) 20 lbs.

Protection—
1. £3501. Rental almost identical with that of 1892.
2. £330.
3. Eighteen watchers, three being permanent.

The Salmon Disease—
No salmon disease in the Findhorn.

The Spawning Season—
1. Upper district, 18th October; lower district, 20th November.
2. Upper district between 21st October and 21st November; lower district between 10th December and 10th January.
3. Upper district, 30th November; lower district about 1st of March.
4. Sometimes 'flood,' 'half-flood,' and 'low.'
5. Less.
6. Upper district from Drynachan to Coignafearn; lower from Moy to Trout Shot.

Kelts—
1. Kelts begin to migrate seaward immediately after the spawning season is finished.
2. January and February.
3. May.
4. Sometimes 'flood,' 'half-flood,' and 'low.'

Smolts—
1. From the end of March till the middle of May.
2. Yes; pretty fair.

DISTRICT OF THE RIVER NAIRN.

Take of Fish—
1. (*d*) Below the average.
2. Approximately; (*b*) 4760; (*c*) 175.
3. (*a*) The 11th of February; (*b*) during the month of April; (*c*) grilse in September; sea-trout in June.
5. (*b*) 35 lbs.; (*c*) 19½ lbs.

Protection—
2. £70 or about 1s. per pound.
3. Two.

Obstructions to the Passage of Fish—
3. The dams are.
5. A free passage at all times.

Pollutions—
No pollutions exist.

The Spawning Season—
1. From the 6th to the 8th of November.
2. Between the 20th of November and the 20th of December.

3. Upon the lower reaches about the 20th of January.
5. Less.
6. The Nairn and the Inverarnie.

Kelts—
1. About the 1st of February.
2. During the month of March.
3. About the 1st of June.
4. Between 'low' and 'half-flood.'

Smolts—
1. From the 20th of April to the 10th of June.
2. Yes.

Proportion of Male to Female Salmon—
Estimated to be about equal.

Fluctuations in the River Level—
By general terms.

Wild Birds' Protection Act, 1880—
Yes. The protected birds are very destructive, and yearly growing more numerous.

DISTRICT OF THE RIVER CONON.

Take of Fish—
1. The take of fish in this district has greatly decreased during the season of 1893. The decrease is attributed to the low state of the river and the lateness of smolts going to sea.
2. Approximately ; (*a*) 5000 ; (*b*) 9000 ; (*c*) 400.
3. (*a*) On the 11th of February ; (*b*) In the months of March and April ; (*c*) The grilse run from the middle of April till the close of the fishing. Sea-trout run principally in April and May.
4.

	February,	March,	April,	May,	June,	July,	August.
(*a*)	70	500	600	450	300	1800	1200
(*b*)	100	400	450	500	450	5000	2180

5. (*a*) 19 lbs. ; (*b*) 25 lbs. ; (*c*) 18 lbs.

Protection—
1. Yes. Rental in 1893, £2944.
2. 10d. per £.
3. Two temporary watchers were employed for three months.

Obstructions to the Passage of Fish—
2. The cruives in this district were not fished during 1893.
3. Dams, no ; cruives, yes.
5. The fish pass affords at all times a free passage to salmon wishing to ascend.

The Salmon Disease—
Inspector has not seen any salmon marked with disease during year 1893.

The Spawning Season—
1. About the middle of October 1893.
2. Between the beginning and the end of November.
3. About the last of December.
4. The river was in 'half-flood' during November.
5. There were hardly as many spawning salmon as last season.
6. The principal spawning streams are—18 in the Conon ; 12 in the Meig ; 2 in the Orrin ; 8 in the Blackwater. There is a great quantity of spawning ground above the Falls of Orrin and Rogie.

Kelts—
1. In the first week of March.
2. From about the middle of March till the end of April.
3. About the first week in June.
4. The river was in medium level.

Smolts—
1. A few in March and April. The greatest migration was in May and June.
2. Fairly good.

Artificial Propagation of Salmon—
There was erected in November 1890, a Salmon Hatchery in this district for the artificial propagation of salmon belonging to the District Board. 200,000 salmon can be hatched out in it annually.

Proportion of Male to Female Salmon—
Pretty equal. Return based on estimate.

Fluctuations in the River Level—
By general terms such as 'flood,' 'half-flood,' 'ordinary,' and 'low.'

Wild Birds' Protection Act, 1880—
In favour of the repeal of 'the Wild Birds' Protection Act, 1880' as to all wild ducks (with the exception of the mallard, widgeon and teal), and common sea gulls, all of which destroy large numbers of parr and smolts.

General Question—
Strongly in favour of prohibiting the use of the gaff for landing salmon, from the commencement of the fishing till May, where nearly all the kelts have gone down to the sea.

THE DISTRICT OF THE KYLE OF SUTHERLAND.

Take of Fish—
1. (*a*) Above the average ; (*b*) below the average ; (*c*) about the average ; (*d*) about the average.
2. Approximately ; (*a*) 4000 ; (*b*) 1000 ; (*c*) 1000.
3. (*a*) in February ; (*b*) in June and July ; (*c*) in June and July.
5. (*a*) 35 lbs. ; (*b*) 30 lbs. ; (*c*) 38 lbs.

Protection—
1. £2658.
2. £221, 10s.
3. Sixteen different watchers.
4. One man tried and convicted for allowing water to run through his mill lade when it was not required for milling purposes.

Obstructions to the Passage of Fish—
6. One. The obstruction referred to was at the Amat Falls on the River Cassley and consisted of an erosion of the rock by the water—forming a sort of shelf which absolutely prevented a single fish ascending the falls and getting to the spawning beds beyond, which extended for miles. The obstruction was removed by 15 men with large steel wedges, crow bars and other levers. They commenced work between 4 and 5 a.m. ; and with the endless patent chain blocks (chains and other material supplied by Sir Wm. Arrol and Co.) it was removed out of the fish pass. At 3 p.m. the Kyle fishery officer and others present observed fish going over the fall without difficulty.

The Spawning Season—
1. The 1st October.

2. Between the 1st and the 30th of November.
3. About the end of December.
4. Very high.
5. About the average.
6. Caron, Oykell, and Cassley.

Kelts—
1. About the middle of December.
2. March.
3. May.
4. Normal.

Smolts—
1. May and June.

SUTHERLAND, EAST COAST DISTRICT.

Take of Fish—
1. (*a*) considerably below the average ; (*d*) considerably below the average.
2. (*a*) Salmon 3158, grilse 1632, trout 752 ; (*c*) Helmsdale 600 ; Brora about 350.
3. (*a*) January ; (*b*) May ; nets not on till 1st May.
4. (*a*)—

	March,	April,	May,	June,	July,	August.	
Salmon	14	11	44	21	7	3	per cent.
Grilse	—	—	—	39	49	12	„ „
Trout	—	—	14	79	7	—	„ „

5. (*a*) 35 lbs. ; (*c*) 31½ lbs.

Protection—
1. All belonging to the Duke of Sutherland no assessment.
3. Four keepers assist in watching.

The Salmon Disease—
1. Little disease on the Helmsdale only. First diseased fish got on 16th April; at its height in May.
2. Very low indeed, owing to long drought.
3. In April, 3 ; in May, 14 males and 6 females ; in June, 2 males, all clean fish ; in November, 25 kelts ; in December, 27 kelts.

The Spawning Season—
1. The 16th of October.
2. 26th October to 14th November.
3. The 24th of November.
4. Very high throughout.
5. Considerably more.
6. Upper reaches and streams of Brora, Blackwater, Helmsdale, and Fleet.

Kelts—
1 December.
2. April.
3. Some of the rivers not free till July owing to low state of river ; but generally free at end of May.

Smolts—
1. In April and on 3rd May many noticed.
2. Yes.

Artificial Propagation of Salmon—
Low end of Loch Brora a small hatchery but last year only used for S. Levenensis ; capable of hatching 150,000 to 200,000.

Proportion of Male to Female Salmon—
Proportion cannot be given ; generally more female than male.

Temperature of Water—
Only on the Shin.

Fluctuations in the River Level—
No gauges.

General Question—
Trout fishing in tidal waters during the period smolts are migrating should be prohibited by law. Large numbers of smolts are then destroyed notwithstanding precautions taken by proprietors and vigilance of watchers.

SUTHERLAND, NORTH COAST DISTRICT.

Take of Fish—
1. (*a*) Below ; (*b*) about ; (*c*) above ; (*d*) above.
2. (*a*) (*b*) 13,200 ; larger proportion (*b*) ; (*c*) 650 ; estimated, no record.
3. (*a*) 6th February ; (*b*) May ; (*c*) grilse 15th May.
5. (*b*) 48 lbs. ; (*c*) 27 lbs.

Protection—
1, 2. No assessment.
3. Five water bailiffs and several gamekeepers, all paid by the proprietor.

Obstructions to the Passage of Fish—
5. At all times.

The Salmon Disease—
No disease ever seen in this district.

The Spawning Season—
1. The 18th of October.
2. Between the 25th of October and the 15th of November.
3. The end of November.
4. Very low.
5. More than for 2 years previously.
6. Naver, Halladale, Strathy, Borgie, and Kinloch.

Kelts—
1. 1st April.
2. April.
3. The middle of May.
4. Unsteady.

Smolts—
1. 1st May, 15th May.
2. Yes.

Wild Birds' Protection Act 1880—
Mergansers—reported by me for years but with no results.

SUTHERLAND, WEST COAST DISTRICT.

Take of Fish—
1. (*b*) Below the average, owing to want of rain at the proper season ; (*c*) slightly above the average ; (*d*) below the average.
2. (*b*) 7857 salmon and grilse ; (*c*) uncertain, but the number was smaller than last year.
3. (*a*) The middle of June ; (*b*) July ; (*c*) July and August.
4. (*b*) March, 3 ; April, 40 ; May, 269 ; June, 3240 ; July, 3873 ; August, 432 ; Total 7857.

Protection—
3. The fishings in this district are protected both by proprietors and fishing tenants whose gamekeepers and water bailiffs watch the waters.

The Salmon Disease—
No salmon disease observed in this district.

The Spawning Season—
1. The beginning of November.
2. Between the 15th of November and the 15th of December.
3. The 12th of January.
4. Flood.
5. Less.
6. Kirkaig, Inver, Laxford and Loch More and Stack, and Inchard and Dionard.

elts—'
1. Early in April.
2. April.
3. June.
4. 'Half-flood.'

Smolts—
2. Fairly good.

Artificial Propagation of Salmon—
There are two fish hatcheries in the district; one at Inchnadamph, Assynt, and the other at Geisgill, Scourie; each of which can hatch annually from 50,000 to 60,000 fish.

Proportion of Male to Female Salmon—
It is impossible to state this for certain, but in netting the river for ova, the proportion of male to female fish then landed was found to be about 5 to 3.

DISTRICT OF THE RIVER BALGAY.

Take of Fish—
1. Average take in fresh water only.
2. No. Chiefly grilse and sea-trout by rod.
3. (*a*) In the month of February; (*b*) August, September, and October; (*c*) July and August.

Protection—
1. Assessable rental, £40.
2. £21, 13s.
3. 2 men.
4. One prosecution under section 27 of 25 and 26 Vict. c. 97, was commenced, but through the intervention of Lord Middleton, on whose estate accused were tenants, it was not proceeded with.

Obstructions to the Passage of Fish—
5. Yes, except at a fall in the Balgay river, where salmon only occasionally pass up.
7. Some pieces of the rock have been giving way at the above fall, which is making the passage easier.

The Salmon Disease—
Not heard of any.

The Spawning Season—
1. October.
2. October and November.
3. Early in December or the end of November.

5. Fully more than usual.
6. The Balgay, Kinloch, Lochs Damph, Dougall, Loane, and Coultry; also the Black Water River and Glen Shielding River.

Kelts—
1. They are generally seen in February, March, and April.
3. June and July; some years later.

Wild Birds' Protection Acts, 1880—
The provisions of this Act might with advantage be modified.

DISTRICT OF THE RIVER LOCHY.

Take of Fish—
1. Below the average throughout.
3. (*a*) The 29th March 1893.
5. (*c*) 39 lbs.

Protection—
1. Yes. There is an increase of £91, 11s. 1d. in rental from the previous year.
2. 1d. per £.
3. 23.

The Salmon Disease—
1. It has not shown itself in the district this year.
4. Have no suggestions to make other than preventing river pollution.

The Spawning Season—
2. 1st of November and 1st of December.
3. About the end of the second week in December.
4. The usual size.
5. The Roy, Spean, Cour, Lochy, Arkaig, Loy, Nevis, &c.

Kelts—
3. The end of April.
4. Low.

Smolts—
1. The end of April or the beginning of May.
2. Bad.

Wild Birds' Protection Act, 1880—
Yes.

DISTRICT OF THE RIVER GIRVAN.

Take of Fish—
1. Below the average in the whole district.
2. Fewer than last year by a long way.
3. (*a*) April; (*b*) September; (*c*) June.
4. No perceptible change in the run.
5. (*b*) 35 lbs.; (*c*) 25 lbs.

Protection—
2. £42.
3. No permanent bailiff. Constable and gamekeepers watch, and are paid for doing so.

Obstructions to the Passage of Fish—
5. Yes. All except Fairlaw Lyn, near the source of the River in Straiton Parish, which should be blasted.

Pollutions—
No fresh cause of pollution, but liquid from Dalquhanan Coal Works still enters the river and destroys very many spawn. The River Pollution Act should be amended so as to apply to such a case.

The Salmon Disease—
1. Almost no disease in the river last year.
3. Very few taken out.

The Spawning Season—
1. In November.
3. February.
5. More than usual.
6. The Girvan and tributaries, and Stinchar and tributaries.

Kelts—
1. January.
2. February.
3. March.

Smolts—
2. Yes.

Wild Birds' Protection Act, 1880—
No doubt millions of salmon and trout ova and fry are killed by birds, more particularly in a dry year such as last. Sea gulls are the greatest enemies.

DISTRICT OF THE RIVER CREE.

Take of Fish—
1. Below the average in all the different classes of fishing.

Protection—
1. £23, 18s. more.
2. 1s. 6d. per £1.
3. Two.

The Spawning Season—
6. The Cree, Minnoch and various tributaries.

Wild Birds' Protection Act—
Not believed to be necessary.

DISTRICT OF THE RIVER DEE, KIRKCUDBRIGHT.

Take of Fish—
1. (*a*) Below; (*c*) below; (*d*) below.
5. (*a*) 42.

Protection—
2. 5 per cent.
3. 10 during spawning season, at other times 1.
4. Three, for fish poaching, convicted.

Obstruction to the Passage of Fish—
2. Yes.
3. Yes.
5. Yes, during period from 6 p.m. on Saturday to 6 a.m. on Monday.

Pollutions—
2. Yes. New drainage being provided.

The Salmon Disease—
1. To a small extent.
2. Average.

The Spawning Season—
1. The end of October.
2. The end of October and the middle of November.
3. The end of November.
4. About the average.
5. Less.
6. Black water of Dee and the Tarff.

Kelts—
1. November.
2. December.
4. Average.

Artificial Propagation of Salmon—
A private hatchery capable of hatching 50,000.

Fluctuations in the River Level—
General observations.

DISTRICT OF THE RIVER NITH.

Take of fish—
1. (*a*), (*b*), (*c*), (*d*) Below the average.
3. (*a*) On the 25th of February when fishing opened; (*b*) in July; (*c*) any grilse taken were got in July. Sea trout were running in May and June.
4. It is impossible to get this information, as fishermen are unwilling to furnish particulars.
5. (*a*) 40 lbs.; (*c*) 30 lbs.

Protection—
2. 5s. per pound of Rental.
3. Three.
4. Nine prosecutions. (1) Contravention of Solway Act (fishing without leave), convicted and admonished. (2) Contravention of Section 21 of 1868 (fishmongers exposing for sale in close time for nets, but open for rods; one of them fined £7, 14s. 6d. or 1 month imprisonment, the other fined £1, 14s. 6d., or 14 days. Case appealed to Circuit Court, when Lord Young quashed conviction. (3) Contravention of Section 18 (having salmon roe in possession), convicted and admonished. (4) Contravention of Section 21 (having a salmon in possession), convicted, 2 men fined £3, 12s. 6d. each or 30 days, aud one fined £1, 12s. 6d. or 14 days. (5 to 9) Five cases charging 9 men with contravention of Section 17 (using gaffs or drag or grapple hooks; all convicted and fined from £2 to £5, or periods of imprisonment from 7 to 30 days.

Obstructions to the Passage of Fish—
2. Have been fished as usual.
3. The cruives are, but not the dams; most of the latter have neither passes, hecks nor sluices in accordance with Schedule.
5. Dumfries fish pass affords passage, except when water at summer level. This pass does not appear to be in accordance with law as it contains a great amount of dead water which affords great facilities for the poachers.

The Salmon Disease—
1. Yes, slightly. First seen in November 1892. At its height in February, and there was little or none seen after the kelts went away.

2. The river was in all its various states during the time the disease was observed; but it was most observed after the river became low.
3. No. But more male fish were found diseased than female.

The Spawning Season—
1. In October 1892.
2. In December and January.
3. In February.
4. All fish spawn soon after a flood.
5. Rather more.
6. No large stream in the district. There are small streams all over its length.

Kelts—
1. About the beginning of February.
2. About beginning of March.
3. In May, excepting that an odd fish was now and then observed all through the season.
4. River was just beginning to rise to flood when the largest number came away. They will not run when the river is low.

Smolts—
1. In May.
2. There was an average run of smolts.

Artificial Propagation of Salmon—
The Board have no hatchery but there is one in the district belonging to a private individual, Mr J. J. Armistead's Solway Hatchery at New Abbey. There is presently a proposal before the Board to stock the river with salmon-trout, probably yearlings.

Fluctuations in the River Level.
By the general terms 'flood,' &c.

General Question—
That amendment or consolidations of the different Acts of Parliament which now govern the Solway Salmon Fisheries is urgently required, and that in the direction of constituting a joint Board of Scotch and English Representatives who shall administer the Laws under one Statue.

DISTRICT OF THE RIVER ANNAN.

Take of Fish—
1. (*a*) Considerably below the average; (*b*) considerably below the average; (*c*) considerably below the average; (*d*) below the average.
3. (*a*) On the 25th February, first open day; (*b*) during August and up to end of fishing on the 9th of September; best takes in tidal waters about 21st of August; (*c*) grilse commenced about the end of June; main run from middle to end of July. Sea-trout beginning of May; main run last fortnight in June.

4. The run of salmon is becoming later but as no record is kept of the number caught, the percentage caught in each month cannot be given.
5. (*a*) No net and coble fishing in this district; (*b*) one salmon, 46 lbs. in Dornock fishery on the 14th of July and on same fishery one 50 lbs. with haaf net on the 17th of July; (*c*) one 50½ lbs. the first week in November in the Newbie portion of the Annan.

Protection—
1. Assessable rental, £65, 9s. more than last year.
2. 4s. per pound.
3. Four (3 at Annan and 1 at Lochmaben).
4. Twenty-six men were convicted at Sheriff Court from Annan division as follow: — 7 For taking or attempting to take salmon during annual

close time ; each fined £2 with expenses. 8. For taking or attempting to take salmon with gaff hooks from river ; each fined £2 with expenses. 4 for fishing with haaf nets having too small meshes ; each fined £1 with expenses. 2 for catching herling with sparling net ; each fined £1 with expenses. 2 for catching herling with herring nets ; one admonished, other fined £1 with expenses. 3 for catching sea-trout between high and low water mark without permission ; one fined £2, others, each £1 with expenses.

Obstructions to the Passage of Fish—

3. No cruives in district. Dam at Welldale Mill, Annan has no heck either at intake or tail end of mill race. Dam at Newbie Mill has no heck at intake of Millrace. Dam at Brydekirk Mill has no heck at tail end of race. Heck at tail end of Millrace at Murraythwaite Mill is broken. These are all on the river Annan and with said exceptions they are all worked in terms of Schedule 9.
5. There is a fish pass in each dam which affords a free passage to salmon.

Pollutions—

1 and 2. None in district.

The Salmon Disease—

1. Yes. First appeared beginning of November 1892. By end of December it was very prevalent. Was at its height during March and April and disappeared about middle of June.
2. Very low.
3. 2 in November ; 13 in December 1892 ; 24 in January ; 44 in February ; 127 in March ; 273 in April ; 6 in May ; and 3 in June 1893. Total 492 in Annan Division. Add Upper Reaches, 177. Grand Total, 669.

The Spawning Season—

1. About the beginning of December.
2. During January and February.
3. About the middle of March.
4. Medium low towards end of season.
5. A little above the average.
6. Northfield, Mount Annan, Luce, Meinfoot, Turnshawhead, Hoddom Bridge, Mainholme and Rotchill in the Annan.

Kelts—

1. About the middle of January.
2. During the month of March.
3. A few were to be seen in the river all summer.
4. River very low during spring and summer months which prevented migrating.

Smolts—

1. Mostly during April and May.
2. Yes.

Proportion of Male to Female Salmon—

This cannot be given accurately, as no notes have been taken but may be estimated at about 3 or 4 females for every male.

Fluctuations in the River Level—

By 'flood,' 'half-flood' and 'low' only.

Wild Birds' Protection Act, 1880—

I have heard of no complaints against fowls referred to in this Act.

General Question—

I would suggest that the attention of the Board be drawn to the Acts applying to the Solway, the middle of which is the boundary between England and Scotland. In this district the fishing with the exception of the Weekly and annual close time is regulated by the Annan Salmon

Fisheries Act, 1841, which, it is contended, only extends in tidal water to low water mark of spring tides. Between low water mark and mid-channel boundary line, a great many fish for salmon, sea-trout, and grilse with haaf and whammel nets without any permission, which is a great annoyance to the occupiers of the different fishings along the coast. The whammel nets licensed by the English authorities are being increased every year, each of the whammel boats having nets from 500 to 800 yards long. Thirty-four of these boats fished from Annan Waterford in 1893. This, in my opinion, is far too many for the extent of the Solway, which is being over fished by them, doing a great deal of damage to the river fishings, and some steps should be taken to prevent these fishermen fishing without permission and to regulate length of net allowed for each boat, which should not exceed 300 or 400 yards. By the English Act, no one can fish on the English side of mid-channel without a license. On the English side of the Solway both weekly and annual close time differ from that on the Scotch side, which encourages poaching. It would be a great advantage to the interests of the fishing if these close times were the same time. The whammel net fishers referred to, have licenses from the Eden Fishery Board to fish on the English side of the Solway only. At a meeting of the Annan Fishery Board held on the 20th of December last, there was a discussion on the general question as affecting the salmon fishings of the Solway and the rivers flowing into it. And it appeared to be the unanimous opinion of the Board that, until a Bill is promoted in Parliament and passed, having for its object the repeal of all existing laws, and their re-enactment in more simple and intelligible form, under the administration of a Joint Solway Fishing Board, no good result would follow or harmony be expected to prevail amongst the many and conflicting interests involved.

DISTRICT OF RIVER FORSS.

Take of Fish—

1. (*a*) Above ; (*b*) below.
2. (*a*) 1000 ; (*b*) 1500 ; (*c*) Very few.
3. (*a*) February ; (*c*) June and July.
5. (*a*) About 30 lbs.

The Spawning Season—

1. About the middle of October.
2. From the 20th October to 31st October.
3. The second week in November.
4. Very highly flooded.
5. About the average.
6. The Forss River and Isauld Burn.

Smolts—

1. 25th April and 1st May.
2. Very good.

Artificial Propagation of Salmon—

A hatchery at Westfield on the Forss River capable of hatching out 200,000 fry ; supported by the shooting tenant ; also a hatchery at Sandside, Reay, supported by T. Pilkington, Esq. of Sandside, capable of hatching out 170,000 fry.

Marking Salmon—

Salmon fry have been reared in a pond at Sandside, and it was proved that some of them, from date of hatching out, were smolts 7 inches long and ready to go to sea in 12 months.

Wild Birds' Protection Act, 1880—

Herons, cormorants, gooseanders, and mergansers are all most destructive to fry.

(Signed) JAS. CAMPBELL, *Sheriff Clerk.*

WICK, 16*th January*, 1894.

NOTE II.—REPORT BY THE INSPECTOR OF SALMON FISHERIES ON THE ALLEGED ILLEGAL USE OF BAG-NETS IN THE MORAR DISTRICT.

I have the honour to report that I have carefully read over a letter from the Under Secretary for Scotland with accompanying correspondence regarding the alleged illegal use of bag-nets in the Morar fishery district. I have also, by the direction of the Fishery Board for Scotland, visited the district to enable me to report on the subject.

The petitioners give the following reasons for their protest, viz.:—

'1st. That these nets will not only capture all fish entering the river 'and Loch Morar, but will seriously injure the white sea fishing on 'which we much depend for food.

'2nd. That they extend so far out that our small row boats are 'obliged to take a wide circuit to which we or our forefathers were never 'subjected from the beginning of the world.

'3rd. That they impede navigation in sailing and tacking.

'4th. That they are dangerous obstructions at night, and may at any 'time cause disaster on a much frequented sea-coast.'

It would seem that bag-nets for the capture of salmon have been in use in Scotland for over 60 years, and that the exercise of the right of fishing by this means is not illegal if the nets are set up on the sea-coast outside the limits of estuaries and rivers, and do not interfere with the superior right of navigation. Mr Stewart writes on pp. 169, 170, and 171 of his Treatise on the Law of Scotland relating to the Rights of Fishing:—'It has been decided. . . . upon a close construction of the statutes 'and of contemporary writers, that the prohibitions of fixed machinery do 'not apply to the proper shore of the sea; and accordingly in those 'localities it is legal to fish in any manner of way. The prohibitions of 'the statutes, however, clearly apply to rivers and estuaries; and the only 'difficulty which remained was to determine the exact line which divides 'the estuary from the sea and which separates the region where fixed nets 'are illegal from the region where they are permitted. . . . The question, 'however, of the boundary line can now be no longer a matter of doubt; 'for, by the Act of 1862, the Commissioners thereby appointed are em-'powered, in the case of every estuary and river in Scotland, to fix the 'line which separates the estuary from the sea.'

On page 92, he writes:—'The right of fishing is always subservient to 'the superior right of navigation'; and again, on page 129—'All rights 'of fishing, including salmon fishing, both in the sea and in the rivers, 'must yield to the more important rights of navigation and commerce; but these supereminent rights must be exercised *sine emulatione vicini*.'

With regard to the complaint that the salmon fishing would injure the white sea fishing, it would seem that, provided the salmon fishermen have a title to salmon fishings, they are simply exercising their right to catch salmon by fixed nets just as the Arisaig and Morar fishermen are exercising their right to catch white fish. The position and length of the fixed nets are pretty well known in the locality where they are set up, and with a little care and attention the two industries are not incompatible.

The points at issue seem therefore to be:—

1st. Whether these fixed nets are within the estuary boundary.

2nd. If they interfere with the superior right of navigation.

The limits of the estuary of the river Morar were fixed by the Com-

missioners appointed under the Salmon Fisheries (Scotland) Act of 1862 (25 & 26 Vict. c. 97, sec. 6, sub-sec. 1) viz. :—'A straight line drawn 'from the Bonan Caraidich on the north side of the river to the outermost 'points of Fraoch Eilean on the South Admiralty Chart (31 & 32 Vict. c. '123, Schedule B).

In order to ascertain the number and position of these bag-nets I took a boat from Arisaig and sailed round the coast to Morar. I found two bag-nets, the first set up off the point of land marked in the Admiralty Chart as Fraoch Eilean, and therefore on the boundary line dividing the estuary of the river Morar from the sea; the second on a point of land half way between Fraoch Eilean and the mouth of the river Morar. This point of land, which is not named on the chart, bears E.N.E. from the outermost points of Fraoch Eilean, and is well within the limits of the estuary where fixed nets are illegal.

With reference to whether these nets interfere with the superior right of navigation, it would humbly seem to me that bag-nets placed in narrow channels or confined waters in the track of vessels or boats, so that the latter were in danger of running on rocks or shoals in endeavouring to avoid them, might be considered to constitute an interference; although, as bag-nets are floating nets, I should hesitate to say that they were so, as smaller boats can pass over them if the rudder is raised, whilst in the case of larger vessels the injury would be to the net and not to the vessel, but the nets in the Morar district present no such exceptional circumstances, as they are set up off points bordering on the open sea coast. It is true that in rowing from Arisaig to Morar boats are not now able to row close round the point of Fraoch Eilean, but are obliged to make a circuit to which they have not been accustomed. This circuit, however, is of limited extent, and there is nothing to prevent its being made, and I fail to see that these bag-nets can be held to constitute an interference with navigation more than any others on the coast of Scotland.

I have the honour to be,

Your obedient servant,

(Signed) WALTER E. ARCHER.
Inspector of Salmon Fisheries of Scotland.

THE FISHERY BOARD FOR SCOTLAND,
EDINBURGH, 4*th April* 1893.

NOTE III.—REPORT BY THE INSPECTOR OF SALMON FISHERIES, ON THE PROPOSED ALTERATION OF THE CLOSE TIME FOR ROD FISHING IN THE RIVERS ISLA AND ERICHT, TRIBUTARIES OF THE RIVER TAY.

I have the honour to report that I have carefully read over and considered a copy of a remit, by the Secretary for Scotland, of petition from the Tay District Board, praying for an alteration in the close time for rod fishing in the river Isla and its tributaries, with copy of relative memorials in favour of the proposed change, from Alyth, Meigle, and Blairgowrie districts, together with a letter from the Secretary of the Fishery Board; further, that I have visited the district, as directed by the Board at their last meeting, to enable me to furnish a report.

On the occasion of my visit to Perth, I met Mr Dickson, clerk to the Tay District Board, Mr Lumsden, superintendent, and Sergeant William Sidy, who had been employed as watcher on the river Isla and tributaries from 1881 to 1891. I afterwards proceeded to Coupar-Angus, where I met representatives of the petitioners, namely, Mr George Whitton, painter, Coupar-Angus, Mr William Crockhart, fishing-tackle maker, Blairgowrie, Mr W. Mitchell, post-master, Rattray, and Mr Charles Scott, president of the working men's angling club.

Mr Dickson was of the opinion that so few fish were taken on these rivers that the extension of the close season would not affect the fisheries of the Tay district generally. Mr Lumsden and Sergeant Sidy stated that few salmon went up the Isla before October. The latter further said the fish were not then in a condition to be taken, being, with but few exceptions, nearly black; that they went up the streams in considerable numbers to spawn, and that extending the close season would enable many spawners to be killed, especially at Coupar Grange Dyke, where they collected in large numbers.

The representatives of the petitioners acknowledged that the majority of the fish were dark coloured, but considered it was by no means the case with them all. They further stated that, although the quality of the flesh might be a little deficient to those accustomed to eating salmon earlier in the season, it was much esteemed by them who had no such opportunity. They complained that the alteration of the close season in 1890, whereby rod-fishing was permitted for 25 days prior to the opening of the netting season on the 10th February, had been of no benefit to them; whereas, closing the rivers on the 15th October instead of the 31st had taken away the one fortnight in the year on which they depended for getting any fishing.

The spawning season on the Isla and its tributaries, I was informed, is usually from the middle of November until the end of December; in some years it continues as late as January. It is clear, therefore, that fish caught during the last fortnight in October must, as a rule, be very much out of condition.

It would, however, seem that the question of the extension of rod fishing on the Isla has a much wider importance than simply whether the fish are in a condition to afford sport and food to certain anglers, or even than how it may affect the fisheries of the district of the river Tay. It appears to involve the principle that each tributary may have its own close time, irrespective of the close time regulating the fishery district

generally. The petitioners maintain that the Earn, being a tributary of the Tay, is a parallel case to that of the Isla, and pray that they may be placed on the same footing. It is true that the river Earn does close sixteen days later than the Tay, and that it is within the limits of the district of the river Tay as defined by byelaw, but it would seem that neither from a geographical nor from a natural history point of view can it be considered a tributary of the Tay, as it empties itself into the estuary of the Tay where it is half a mile broad; further, this river is the only exception to the otherwise unbroken rule that there is but one close time in each district. The Isla, on the contrary, joins the parent river 13 miles above Perth, and occupies the same position as the Tummel, the Lyon, the Dochart, the Lochy, or any other tributary stream. If the Isla, therefore, were granted a special close time on the ground that salmon do not ascend in any numbers until late on in the season, similar extensions might be claimed in the case of every tributary where the same circumstances prevail. In all salmon rivers salmon only seek some of the tributaries, more particularly the smaller streams and burns, on the eve of spawning; and it would humbly appear to me that it would be most injurious to the salmon fisheries generally, to admit the principle that, as there had been no previous opportunity of killing salmon in any particular tributary, therefore the season was to be extended beyond that prevailing in the district generally.

I would venture to suggest that the Fishery Board for Scotland should express the hope that the Secretary for Scotland will not grant the petition of the Tay District Board without careful consideration of the effect such a precedent may have on the Salmon Fisheries of Scotland generally.

I have the honour to be,

Your obedient servant,

(Signed) WALTER E. ARCHER,
Inspector of Salmon Fisheries of Scotland.

THE FISHERY BOARD FOR SCOTLAND,
EDINBURGH, 6*th April* 1893.

NOTE IV.—REPORT BY THE INSPECTOR OF SALMON FISHERIES ON CROWN UNCHARTERED INLAND WATERS IN SCOTLAND.

In accordance with the instructions received at the Board meeting of the 18th instant, I have the honour to submit, for the information of the Secretary for Scotland, a report on a paragraph, referring to Crown unchartered waters in Scotland, contained in the last report of the Trout Preservation Society of Glasgow.

The paragraph referred to is in the following terms :—'The prospect of 'legislation regarding Crown fishings being reserved for angling purposes, 'under proper conditions, is now brighter. It is expected that these 'waters shall be kept for the benefit of the public, under certain necessary 'conditions for the regulation of the fishings. In view of the increasing 'number of anglers from all parts of the United Kingdom that frequent 'the open fishing waters in Scotland, it is found to be difficult to prevent 'over fishing in those waters; but, should the use and enjoyment of the 'Crown unchartered waters be added, this would confer a boon which 'would be appreciated not only by anglers, but by a large section of the 'public. Your Committee have kept this subject before Members of 'Parliament for Scotland, irrespective of party.'

With reference to that part of the above quoted paragraph relating to Crown unchartered waters, the following question appears to be raised, viz. :—Whether such waters should be reserved for the benefit of the angling public?

In dealing with this question I propose to consider, as far as the information at my disposal will permit, first, what extent of fresh water fishings still remain vested in the Crown; and, second, how such a proposal, if carried out, would affect the interests of the salmon fisheries generally.

The commission appointed in 1889 by a previous Secretary for Scotland, to inquire into Crown Rights in Salmon Fisheries in Scotland, reported that the Crown Rights in rivers and lochs, other than tidal, are, so far as known to them, exceedingly limited. The rental of them in 1888 was under £20. But there is this peculiarity affecting them, that these rights are liable to emerge; that is to say, if by the removal of obstructions, salmon are permitted to ascend rivers to which they never had access before, the Crown claim the right to the salmon fishing, where the riparian proprietors or others have no chartered right.

The fisheries which may thus emerge are extensive. In the case of some of them, it is said, that the cost of making the falls passable to salmon would not be repaid by the improvement likely to arise from the fresh spawning grounds which would by this means be opened up; but with regard to the majority the difficulties appear to be rather of a legal than of an engineering character. It is stated in the *Ninth Annual Report of the Fishery Board for Scotland*, that :—'There are three chief 'causes which have operated to prevent the opening up of the obstruc- 'tions, which at present bar about 500 miles of rivers and lochs against 'the ascent of salmon. These are (1) the natural unwillingness of the 'proprietors of such falls to allow them to be interfered with, sometimes 'because there is a productive pool immediately below the falls which 'they fear might be spoiled, sometimes from consideration of amenity— 'such proprietors possessing at present an absolute veto, there being no

'means provided by which arrangements can be made for opening up 'the falls and compensating the proprietors in the event of their refusing 'their consent; (2) the claim of the Crown to all the new Salmon 'Fisheries that may be created by the opening up of the natural obstruc- 'tions by the riparian owners; and (3) the claim put forward in certain 'cases by a proprietor below a fall—founding upon a charter granting 'him the Salmon Fishings throughout a whole district of country—to the 'Salmon Fishings above the fall in the event of its being opened up, 'though neither the fall nor the river above it are his property. But 'for the operation of these three causes, we believe that many of the 'natural obstructions in our Scotch salmon rivers would by this time 'have been made passable.'

Besides, however, the fishings which might emerge through the opening up of obstructions, it was alleged by some of the witnesses before the Commission on Crown Rights in Scottish Salmon Fisheries in 1889, as well as before the Commissioners appointed in 1874 to inquire into the operation of the Tweed Fisheries Acts, that the titles of some persons exercising the right of salmon fishing were defective. Similar opinions were expressed before Messrs Buckland & Young when engaged in inspecting the Scotch salmon rivers in 1870. Mr Archibald Young, late Inspector of Salmon Fisheries of Scotland, in his 7th Annual Report to the Fishery Board for Scotland, makes the following remarks:—'Much 'has been spoken and written about the unchartered salmon waters in 'Scotland in connection with the late Salmon Fisheries Consolidation 'Bill.'

'The following recommendation, agreed to at a meeting of the Forth 'District Board, dated 4th March 1870, and published on page 86 of the 'report of 1871 by Messrs Buckland & Young, special Commissioners 'appointed to inquire into the effects of recent legislation on the Salmon 'Fisheries in Scotland, is worthy of attention as containing practical 'suggestions for the disposal and taxation of all the ungifted Salmon 'waters in Scotland. This recommendation is supported by Messrs 'Walpole & Young in their report of 1875, on the operation of the 'Tweed Fisheries Acts of 1857 and 1859, in which they write as follows, 'under the head of Unchartered Waters on the Tweed:—"This recom- '"mendation was supported by the District Boards of the rivers Spey, '"Deveron, Annan, and Lochy. It is at all events clear and definite, and '"proposes to give in the first place, to the riparian owners who have no '"title, the power of buying from the Crown the right of salmon fishing '"in the waters *ex adverso* of their properties. On the other hand, the '"proposals made with regard to this subject by most of the witnesses '"who gave evidence before us had for their principal object the depriv- '"ing of these riparian proprietors of any chance of acquiring the right '"of salmon fishing in the ungifted waters—except as members of the '"public—and the conferring of that right on the public generally. '"This, we venture to think, would be an intolerable hardship on these '"proprietors, and a very doubtful boon to the public; and we cannot, '"therefore, recommend that any such proposal be adopted.'"

The Crown Fisheries, however, are under the management of H.M. Commissioners of Woods and Forests, and there are, therefore, no means of knowing, from the records in the office of the Fishery Board, whether the unchartered waters are so great as these remarks would seem to imply.

The second point to be considered is, how the general fishing interests would be affected if the unchartered inland waters were reserved for the benefit of the public. It is very evident that this question can only become of practical importance, in the event of the Crown becoming

possessed of a much greater extent of inland waters frequented by salmon, than those known of at the present time.

In considering this question it is desirable to keep clearly in mind what are the interests of the salmon fisheries generally. These appear to be bound up in the question of how the greatest number of salmon can be captured for food without injuriously affecting future years' supply.

It is generally admitted that in order to maintain the future supply of salmon, it is necessary to protect:—First, the parent salmon in order to insure a plentiful harvest of eggs; second, the eggs after they are deposited until they are hatched; third, the young when hatched until they go down to the sea. In order, however, to secure a thoroughly successful spawning season, it is not sufficient to provide a good supply of breeding fish, nor even to secure their adequate protection during the spawning season. Any person who has watched salmon spawning must have observed how, if overcrowded in any one part of the river, they will turn over the already sown beds and destroy to a great extent the work previously done by others. In this way, there can be no reasonable doubt, that large numbers of eggs are lost. The principal condition, therefore, to a successful spawning season, and a condition which no pains should be spared to secure, is that the breeding fish should be properly distributed over the whole river, and that no unnatural proportion of either sex should be protected.

It is well known that salmon ascend different rivers at different seasons of the year, in some early, in others late, whilst in most of the large rivers on the east coast there is hardly a month of the year in which some fish are not ascending. Why salmon, which presumably seek the fresh waters for the purpose of spawning, should ascend the rivers in the early months of the year when their roe is very slightly developed, is a question which has given rise to many different and conflicting opinions. The greater weight of evidence, however, appears to support the opinion that this apparent anomaly is a provision of nature to insure a distribution of fish throughout the whole river, and there are even grounds for supposing that the due distribution of each sex is in this way provided for.* But, whatever the reason may be, the following facts remain:—First, that salmon ascend some rivers at all times of the year; second, that in some rivers, at any rate, the early fish press right up to the head-waters at once; third, that the early fish having roes weighing only some three or four ounces are able to develop ripe eggs without revisiting the sea.† It

* Appendix to Eleventh Annual Report of the Fishery Board for Scotland, page 18.

† It has been considered by some persons that the so-called 'clean-fish' which enter the rivers in winter and spring are not breeding fish, in fact that it would be impossible for their eggs to develop so long as they remained in fresh water, and these persons further contend that the real spawners only come in during the autumn time. Some evidence was advanced by Dr Day, in his book *British and Irish Salmonidæ*, in support of this theory. He says:—'In November 1885, being with 'Sir James Maitland searching for salmon eggs in the Teith near Stirling, we took a 'female, 15lb. weight, so injured by seals that it succumbed. It was a clean silvery 'fish, with ovaries 4·7 inches in length, the two weighing 2½ ozs., and each egg being '0·1 inch in diameter. It is clear that a salmon, having eggs one-tenth of an inch 'in diameter at the end of November could not have its ova sufficiently ripe to 'spawn within the next two months, while experience tells us that no other period 'for depositing eggs will normally come round before this time the succeeding year. 'November 26, 1886, out of nine salmon netted in the same place three were clean 'newly-run fish. It has long been accepted as a physiological necessity that a 'female smolt must descend to the sea before it can develop eggs, the reason 'advanced being, as stated by Rasch in 1866, that the development of ova requires 'far more nourishment than that of milt; that in the ovary of the female the eggs 'are developed nearly simultaneously, and their development is uniform, one being 'enveloped in as large an amount of albumen as another. But in order to produce

would appear, therefore, important to protect a proportion of *every* run of salmon. Regarding this question the Fishery Board for Scotland in their

'this albumen, a far greater quantity of food is needed than the fish can normally 'procure in fresh water rivers. On the other hand, grilse at Howietown, both last 'year and during the present season (1884–85 and 1885–86), have given eggs without 'descending to the ocean.

'I think that the explanation of these apparently contradictory facts is possible. 'Thus, it is generally admitted that salmon, while residing in rivers, do not increase 'in weight, but rather fall off the longer they are absent from the sea, existing 'mainly as they do upon the fat which they have accumulated while feeding in the 'salt water, and such food as they can procure is sufficient for the nutrition of the 'body, but insufficient in females for breeding purposes. If this is so (and of it I 'think there can be no reasonable doubt), they would be unable to obtain enough 'nourishment wherewith to develop eggs so long as they continue in the river, that, 'in short, they could not do so without another visit to the sea; consequently, 'these early ascending salmon, until they have descended to salt water, cannot be 'those fish from which we have to expect ova for replenishing the stock in our rivers. 'Knox, in 1854, observed that a smolt, after first descending to the ocean and 'tasting its marine food, never again resorts to its infantile food as a constant mode 'of nourishment.

'This brings me to the question of how it is possible to prove that insufficient 'nourishment can impede or prevent spawning among the salmonidæ or, in fact, 'render a fish temporarily sterile. An instance will be adduced further on to show 'how fungus among the American char was checked by decreasing their food, but as 'one result those fish from Howietown became sterile for the season.

'Deficiency of food may, therefore, occasion sterility by an entire arrest of develop- 'ment in the ova, or, should the eggs be formed in the ovaries, it may stop (possibly 'not entirely) their further augmentation in size, as cold will retard the development 'of the embryo in the eggs that have been deposited, as has been abundantly proved 'by transmitting them to distant countries by the assistance of ice. Possibly, in 'some few instances, these early ascending fish may find a locality where food from 'some cause is unusually abundant, allowing the ova to augment in size, and this is 'the explanation of occasionally a female salmon with large eggs being captured at 'the end of the summer; but normally these fish will be sterile during the year of 'their ascent in the condition described, at least until after they have re-visited the 'sea.

'But it may be advanced if this is so, how do land-locked salmon breed? 'Here we have an entirely different set of circumstances to deal with. The fish 'have never been to the sea-feeding grounds, but have been compelled to adapt them- 'selves to local conditions. Thus, in large lakes, as Wenern and other suitable 'places where food abounds, they breed, or else they become demoralised salmon, as 'Agassiz remarked, or, finally, they may die out, due to sterility, the nourishment 'which they are able to obtain being insufficient or unsuited to allow them to 'perpetuate their race.

'There is hardly a month in the year when fresh-run salmon may not be found in 'our rivers, but the main run for spawning purposes, occurs as a rule from October 'to January, or even later. Some of the December or January fish, however, are in 'that condition, as I have shown that they could not spawn for many months to 'come; and I am disposed to think that it is only autumn and winter ascending 'ones that breed, but experiments are much needed to test this.'

I have quoted the above passage in full, as it appears to me a matter of very great mportance. If it is true that only autumn and winter ascending fish breed, then the improvement which has been noticed in the rivers Dee in Scotland, Usk in Wales, and Sand in Norway cannot have been influenced by protecting a certain number of every run of fish, as the clean fish ascending in the winter, spring, and early summer are useless for breeding purposes. Further, the improvement which has taken place in the fishing on the Helmsdale river in Sutherlandshire, during the last thirteen years, cannot have been affected by the protection afforded to the fish ascending the river previous to the 1st May. It is stated in the Appendix to the Eleventh Annual Report of the Fishery Board for Scotland that:—'In 1876 net 'fishing at the mouth of the Helmsdale was suspended from the 11th February to the '1st May, with the view of improving the angling in the river. Notwithstanding 'this change the yield of the nets does not appear to have suffered; on the contrary, 'during the period of thirteen years, 1877–89, it represented 49% more fish than in 'the corresponding number of years from 1864–76, when the nets were worked 'throughout the whole season. In the river Brora, which flows into the sea a few 'miles south of the Helmsdale, where nets have been used throughout these twenty- 'six years for the whole season, the yield of the net-fishing 1877–89 was only 28% 'better than for 1864–76.' If it is only the autumn and winter ascending fish that

Eleventh Annual Report make the following recommendation :—'Many 'opinions prevail as to which run of fish is of the greatest value for

breed, then fishing by means of cruive dykes and nets in fresh water is not detrimental to the fisheries, and the weekly close time is of no use except to enable a greater number of persons to share in the fisheries. Indeed, if this is true, the only matter of importance is to protect the fish during the annual close season. It will be observed, however, that the evidence Dr Day gives in support of this theory is, first, the case of the female smolt which does not develop ripe eggs so long as is remains in fresh water; secondly, that of some American char which became temporarily sterile when their food was decreased. It would, however, seem to me that neither of these fish offer a parallel case to that of the adult clean salmon ascending the river in the winter or spring, as neither had visited the sea to enable them to accumulate a large quantity of fat. I should, therefore not be inclined to assume, with Dr Day, from the evidence of these two instances, 'that this fat,' in the adult salmon, 'together with such food as they can procure in the river, is sufficient for 'the nutrition of the body, but insufficient in females for breeding purposes.' The experiments, however, which have been conducted on the river Aaensira in Norway seem to settle this question beyond a doubt.

On the river Aaensira in Norway, there are two impassable falls close to the sea. The lower fall is 27 feet high, the upper 88 feet high. Salmon passes have been made to enable fish to surmount them. Owing to legal difficulties, however, these are not used for the purpose for which they were intended, but the fish are confined in an artificial channel at the head of the salmon-pass over the first fall, from the time they enter in June, until the spawning season. The channel, which is about the size of an ordinary mill-lade, is about 100 yards long. The fish enter it through inscales similar to those used in cruive boxes, whilst their exit at the upper end is stopped by an iron grating, so that once in they have no option but to remain. It is quite clear, therefore, these fish cannot revisit the sea, nor can it be advanced that food is likely to be unusually abundant in such a locality; on the contrary, it would seem probable that where large numbers of fish are collected in a small space food would be deficient. The fish which come up in June have a high crest, a slight development of roe and a large quantity of fat on the pyloric appendages. The appearance of those ascending later changes as the season advances. If it is the case that salmon cannot develop ripe ova in fresh water owing to insufficient nourishment, these early salmon must be found sterile when the spawning season arrives, for as has already been shown they cannot revisit the sea. It has, however, been found from observations extending over seven years, and comprising 2003 fish, that neither the season of the year at which they enter the river, nor their condition on entering, have any influence on whether they spawn or not, as, with two exceptions, all yielded ripe ova or milt when the spawning season came round.

The greater weight of evidence would appear to support the opinion that the reason why salmon ascend the rivers at different seasons of the year is to insure a distribution of fish throughout the whole river. For, as Mr Willis Bund remarks in his book *Salmon Problems*, 'it must make some difference to a fish surmounting obstacles, 'whether she carries 4 oz. or 60 oz. of roe.' Further, a fish which ascends six or eight months before the spawning season, must have more opportunities of finding the river at a suitable level for surmounting obstructions than one ascending later.

If fish ascended the rivers in the spring of the year only to rid themselves of sea-lice, as some consider, they might be expected to ascend only a short distance; whereas, it seems, on the contrary, that in some rivers, at any rate, they press up immediately to the head waters. Thus, in the Forth District, it is said to be the floods in January and February that induce the fish to ascend to Lochs Vennacher and Achray. In the Tay District, the fishing is best in the Loch Tay in the early months of the year; and I am informed by a gentleman well acquainted with the fishings at the foot of the falls of Tummel, that it is the March floods that give a successful season in those waters, whereas the autumn fish do not ascend so far. The superintendent of the river Dee, in Aberdeenshire, informs me that the spring fish in that river press up stream into the tributaries, some 15 to 20 miles above Braemar; whereas the autumn fish, which collect in the greatest numbers between Banchory and Ballater, are seldom found above Braemar. He distinguishes between spring and autumn fish from the fact that fish taken ascending the river in the spring are, as a rule, small fish, whereas those taken in the autumn are considerably larger. Small fish, corresponding in size to the spring fish and much discoloured, showing they had been in the fresh water a long time, are found in the upper part of the river, and are the first to spawn; whereas the fish in the lower part of the river resemble, in size, those caught during the autumn, and present the appearance of having more recently left the sea.

In the district of the river Ness, the fish run straight through the river Ness and Loch Ness into the river Garry. The river Garry flows into the upper end of Loch

'breeding purposes; but while we are still in ignorance of the many 'complexities which may arise from an interference with the natural run 'of salmon, we would not feel inclined to depart from the safe course 'which has always formed the basis of salmon fishery legislation, viz., to 'provide for the free passage of a proportion of every run.'

As I pointed out on page 16 of the Appendix to that report the application of this principle has been followed on the Aberdeenshire Dee by the improvement of the fisheries in the tidal as well as in the non-tidal

Ness. Indeed, it is said that, although the Oick and Garry fish must pass up the Ness, scarcely any settle there, no fish being taken in the Ness by the fly before July. The same is said of the Orchy on the West Coast. The Orchy flows into Loch Awe, which is connected with the sea by the river Awe. The Awe is a late river, the heaviest salmon being got in the autumn, while the Orchy below the falls is best in the spring. The spring fish are said, as a rule, to come right up to the long, deep, rocky pool below the falls. In the river Severn in England, Mr Willis Bund, in his book *Salmon Problems*, says, that there is a spring run of small salmon, weighing from 8 lbs. to 15 lbs., in February and March. These are very strong active fish, and press up the river at once, those getting to the top forming the early spawners. These instances are sufficient to show that in some rivers, at any rate, clean fish, having their roe very slightly developed, ascend at once to the head waters of the river.

It will be observed, also, that the observations of Mr Willis Bund on the Severn, and the superintendent of the water bailiffs on the Dee, tend to show that the spring fish are the early spawners, and form the breeding stock in the head waters of the rivers. The observations of Mr Ffennel, one of the commissioners appointed under the Salmon Fisheries (Scotland) Act of 1862, correspond with those of Mr Willis Bund and the superintendent of the Dee. In his evidence before the Select Committee of the House of Lords in 1860, he said that the salmon which entered the rivers in November, December, January, February, and March, spawned in the following October. He said that in the river he had lived upon, the Suir, he had watched salmon from childhood; in February new fish came up plentifully, the water got very low and clear, and they could see them in the pools through the summer. He had, therefore, no doubt that salmon would live and thrive for a whole twelve months in fresh water. He further stated that these fish, although discoloured, remained very fat and exceedingly good to eat up till midsummer.

At Sand in Norway, where I watched the habits of salmon for some years, the early fish having high crests and slight development of roe, came into the river in June. These fish, as soon as they could pass the first fall, ran right up to the second, whereas the lower pools did not contain fish in any numbers until late on in the autumn.

In the description I gave of Sand's river in Note 2 of the Eleventh Annual Report of the Fishery Board for Scotland, I explained that the water is exceedingly clear and transparent. This circumstance facilitates observation, and the fish can be seen lying in the clear rocky pools throughout the summer. As the summer advances those which have apparently been some time in the river become red, whilst others, presumably later arrivals, are of a brighter colour. Although on most days some fish may be seen ascending the numerous falls with which the river abounds, none are ever seen descending during the summer or autumn. On the contrary, the fish seem to congregate in greater numbers in the pools as the summer and autumn advance. In fact, as far as I am aware, every circumstance tends to show that these fish remain in the fresh water without revisiting the sea; and the experimental nettings, which I made during seven winters, show that all fish yielded ripe ova or milt when the spawning season came round.

If it were the habit of salmon which have ascended high up a river to revisit the sea, I should have expected that this would have been the case in a small river draining the valley of Varmedal in Norway. This river has a drainage area of only seventy square miles, and does not drain any high snow mountains, consequently after the snow on the lower hills has melted it becomes very low and the water much heated. The salmon, however, which have ascended during the spring floods, do not return to the sea, but find shelter in holes under large boulders with which the bed of the stream abounds. It is at such times that the chief fishing takes place, as the fish are easily frightened from their hiding places with poles and sticks, and killed as they lie splashing in the shallow water. These instances tend to show that the rivers can only be properly stocked with spawning fish throughout their whole course, by protecting a proportion of every run. This, however, is just one of those questions which can only be definitely solved by a Central Board provided with powers to make experimental investigations on a large scale.

waters. The same principle, also, in the River Usk, in Wales, was followed by an extraordinary general improvement of the fisheries within the district. Again it will be noticed in Note 2 of the report referred to above that the application of this principle on Sand's river, in Norway, was followed by the number of fishermen on the more open waters of the sea-coast within the district, increasing from an average number of 82 in the years 1880–83, to 112 in the years 1884–87, and 182 in the years 1888–91, whilst in the last named period each net gave an increased yield of 22 per cent. over that in the first named period. I may further mention that advices received during the last two years show a still further increase in the yield of these fisheries.

It is also worthy of note that, notwithstanding the large numbers of fish in the Aberdeenshire Dee at every season of the year, very few are reported as dying of salmon disease (*Saprolegnia ferax*). Indeed, the Dee, where a certain proportion of every run of fish is protected, presents a most marked contrast in this respect to the Tweed, where, on the contrary, netting is so continuously and efficiently carried out during the open season that practically all fish ascending the river at that season of the year are captured; and the breeding fish, therefore, are furnished almost exclusively from those which ascend the river during the annual close time.

It is clear, however, that it is useless to provide for the free passage of a certain number of every run of fish through the tidal waters, if they are only to be caught in the fresh waters. It is possible to control the tidal nets by providing a weekly close time; whereas, if fishing, whether by cruives, nets, or indeed any other means for the purpose of gain, is pursued in the confined fresh waters where fish collect for weeks and months previous to the spawning season, the weekly close time only serves to transfer the take of fish from one set of proprietors to another, and enables practically all fish seeking the rivers during the open season to be captured.

The principal object, therefore, to be aimed at in the public interest, is to confine the commercial fisheries, as far as possible, to the tidal waters, and to afford the fish every possible protection when once they have reached the fresh waters. I can hardly, therefore, anticipate that allowing the public to fish gratuitously in the inland waters would be for the benefit of the fisheries as a whole; on the contrary, the high value of salmon would offer so powerful an inducement for their capture, that I venture to think it would be found extremely difficult to confine such fishing within reasonable limits.

This is, however, not the only difficulty which would arise from allowing the public to fish gratuitously in inland waters. It will be noticed, from the reports of the late inspector, and from the report for 1892 which I had the honour to submit to the Fishery Board, that the Salmon Fisheries of Scotland at the present time are very far from being regulated in such a manner as to provide for the protection of a certain proportion of every run of salmon. In the middle ages the tendency seems to have been to concentrate the fishings at those points where the fish could most easily be captured. This even went so far as to lead to the erection of cruive dykes, fishing weirs as they are called in England and Ireland, which obstruct artificially the natural run of salmon, and practically confer the monopoly of the fisheries on one proprietor. One of the cardinal principles, however, of the wave of salmon fishery legislation which passed over Great Britain and Ireland in the years 1861, 1862, and 1863 was to provide a free passage for fish at all times from the sea to the head waters of the river. In order to give effect to this principle, restrictions were imposed to prevent, as far as possible, fishing at places where fish con-

gregated, and where consequently their free passage could be obstructed. The chief difficulty, however, which would appear to have stood in the way of carrying out such restrictions, has been these old established fishing rights. This difficulty would appear to have been so great in Scotland, where the nature of the Crown rights in salmon fishings has been established to be that of *privatum patrimonium*, not as in England and Ireland, a right held in trust for the public, that even the partial remedies provided by the English and Irish Salmon Fishery Acts were not introduced into the Scotch Acts. The question of the suppression of these fisheries will form one of the principal subjects to be considered in future salmon fishery legislation. As has already been said, it was shown in the Eleventh Annual Report of the Fishery Board for Scotland that the greater weight of evidence went to prove that, if the salmon fishing industry were restricted to the more open tidal waters, it would provide employment for a greater number of persons, and that the fisheries would yield more fish; while it is generally acknowledged that such fish are in better condition. If this is so, it is clear that it is for the public interest that netting in the confined fresh waters should be suppressed. When, however, these fisheries are held legally, it would not seem fair to suppress them without granting compensation to their owners; there are also the old established fishermen to be considered.

The solution of this problem seems to lie in the new factor which has been created by the ever increasing value of good angling. In the first place, fair and legitimate angling for recreative purposes only is the least detrimental method of fishing that can be pursued in fresh waters, for while the percentage of fish taken is very small, it offers no obstruction to the natural run of salmon, and further the presence of anglers on the river is the most practical way of preventing the fish being taken in any other way; secondly, it is generally acknowledged that the high value of good angling renders it remunerative to abandon net fishing in fresh waters. As an instance of the value of angling I may mention that Mr Dickson, clerk to the District Board of the river Tay, informed me that the rod-fishing of 4 miles of one side of this river let last year for £1100.

On the river Dee in Aberdeenshire the compensation to the owners of the fresh water nets has been raised by voluntary assessment among the proprietors. That this arrangement has been remunerative to the proprietors is shown by the fact that, while the amount paid as compensation to the owners of the netting rights is but little over £700 a year, the assessable rental of the district of the river Dee has increased a little over £5000 a year since the fresh water nets were suppressed. The assessable rental of this district in 1876, four years after the Dee Salmon Fishing Improvement Association first began removing fresh water nets, was £8897, 2s. 10d., in 1882, £9931, 6s. 6d., and in 1892, £13,911. The benefit to the public from the increase of the supply of salmon available for consumption has already been discussed.

On Sand's river in Norway the nett rental paid for the fishing rights was nearly double the gross average yield of the fisheries for the previous four years, as given in the report of the Norwegian Fishery Inspector for the years 1880–83. Notwithstanding that this rental was so much in excess of the previous value of the fisheries, the improvement which followed the removal of the cruives and fresh water nets, together with the high value of good angling, has since caused the arrangement, as on the Dee, to be thoroughly remunerative to all concerned. It has likewise removed a cause of bitterness of feeling between the conflicting interests on the river, which in former times led to breaches of the peace. On this river, as is the case in many rivers in Scotland, the principal fresh water fisheries were situated below an obstruction near the mouth; con-

sequently they gave employment to only a few persons. When they were given up ten old-established fishermen had to be provided for, while their removal was followed by ten times ten fishermen finding it profitable to avail themselves of their right of fishing in the more open tidal waters, and at the same time the supply of salmon available for public consumption was nearly trebled.*

At a meeting of the upper proprietors of the river Tay on the 18th instant, it is reported that the following resolution was adopted :—'That 'this meeting of the upper proprietors agree generally to the proposals 'submitted—namely, that the net fishings at present in use above the 'Linn of Campsie shall be taken off, and the owners thereof shall be 'compensated by voluntary assessment on all fishing proprietors above 'the Linn to the extent of one half, the other half to be contributed by 'the Tay District Board.' I am informed that similar arrangements have been spoken of on many of the rivers of Scotland, and would have been carried out except for the difficulty of obtaining unanimity where so many persons are concerned. It would seem, therefore, that the high value placed on the privilege of angling, if properly applied, presents a most efficient way of removing the difficulties which have hitherto prevented one of the leading principles of salmon fishery legislation being carried out. But in order to maintain this value angling must of necessity be restricted to the few.

Should it, however, be considered expedient to extend the privilege of fishing, in Crown unchartered inland waters, to a larger section of the public, I would venture to submit, in order that the general fishing interests should not be injuriously affected, that two points should be kept in view, viz. :—First, that some scheme should be devised for the suppression of instruments for the capture of fish in fresh waters other than rod and line; second, that angling should be allowed only on such conditions as would insure its being pursued for recreative purposes.

I have the honour to be,

Your obedient servant,

(Signed) WALTER E. ARCHER,
Inspector of Salmon Fisheries of Scotland.

THE FISHERY BOARD FOR SCOTLAND.
EDINBURGH, 29*th December* 1893.

* See page 59 Appendix to the Eleventh Annual Report of the Fishery Board for Scotland.

NOTE V.—REPORT BY THE INSPECTOR OF SALMON FISHERIES ON THE RECENT DESTRUCTION OF FISH IN THE RIVER DOON.

I have the honour to report that, in accordance with instructions received at the last Board meeting, I visited the district of the river Doon for the purpose of ascertaining if the destruction of fish complained of still continued, and whether it was due to poisoning or to salmon disease.

On the occasion of my visit to Ayr, I met Mr Dunlop of Doonside, Ayr; Mr Thomas Smith, factor to the Marquess of Ailsa; Mr Alexander Loudon, solicitor, Ayr; Mr Robert Cunningham, forester, Doonside; and Mr David Powrie, water-bailiff, Doonfoot, Ayr. I afterwards drove to Skeldon, where I met Mr Hammond, occupier of the Skeldon Mills The following day I went by train to Waterside, and, accompanied by Mr Gavin, secretary to the Dalmellington Iron Company, and Mr John King, water-bailiff, inspected the Dalmellington Iron Company's premises.

It was generally admitted that the recent destruction of salmon and other fish occurred on two separate occasions. The first occasion was on the 16th October and following days, when 68 salmon and 62 sea trout and whitling, besides large numbers of small fish, were taken out of the river in a dead or dying condition by the witnesses King, Powrie, and Cunningham. Dead fish, it was said, were also removed by others. John King was of opinion that the destruction of fish on his beat was complete, very few live fish having been seen above Skeldon Bridge since.

The second occasion was on the 2nd December and following days. The destruction of fish on this occasion extended to the sea, and was greater than on the first occasion, the number of fish taken out of the river by King, Powrie, and Cunningham being 135 salmon and 294 sea trout and whitling, besides large numbers of small fresh water fish and flounders. These witnesses stated that none of the fish bore marks of any injury, nor were there any signs of fungus disease which would account for their death. In April a few fish had been killed by fungus disease (*Saprolegnia ferax*), but none since, with the exception of one fish found on the sea-shore about 100 yards from the mouth of the river on the 27th of December.

It seems further to be admitted that the destruction of fish on the first occasion was caused by the discharge into the river of a large quantity of waste liquid from a settling pond at the Dalmellington Iron Company's works at Waterside, about two miles from Patna.

Mr A. Gavin, secretary to the Dalmellington Iron Company, said that in January 1893 the company first began manufacturing ammonia, pitch, and tar. The waste liquid from this manufacture, he admitted, was of a poisonous character; but he stated that the company had erected evaporating works to consume it. As a further precautionary measure they had made a settling pond, into which the liquid was run when the evaporating works were not in working order. He said that through the accidental bursting of the embankment at the lower end of the pond a considerable quantity of poisonous matter had escaped into the river, and that this accident was coincident with the destruction of fish in October. Since then an iron tank has been erected, and the liquid waste, which was formerly consumed or run into the settling pond, is carried in iron pipes into the tank and again put through the process. By this means

the deleterious matter is further extracted, and the waste rendered less poisonous. He was, however, unable to account for the destruction of fish in December, and was of the opinion that the cause must be sought for elsewhere.

It seems, therefore, that the only question in dispute is—What caused the destruction of fish in December?

John King, water-bailiff on the upper part of the river, said that the dead fish presented the same appearance on both occasions, and that the river water had a similar smell. He knew of no other mill from which poisonous matter capable of destroying fish in such quantities could proceed. He said that the only other factory on the river was Mr Hammond's at Skeldon. I inspected this factory, and found that the liquid waste from washing the woollen goods is run into a settling pond, which can be emptied into the river by opening a sluice gate. John King thought that this liquid was not injurious to fish, even if it had escaped from the pond, as such an accident occurred some time ago, but, although he examined the river carefully afterwards, he found no dead fish. He was convinced, however, that such an escape had not taken place recently, as he had had occasion to pass this pond every day, both before and after the destruction of fish in October and December, and had noticed no alteration in the level of the pond, which he must have done had the liquid been run off. He was further led to form the opinion that the destruction of fish could not have been due to Mr Hammond's works, from the fact that dead fish were found four miles above Skeldon Mills. He inspected the premises of the Dalmellington Iron Company on the morning of the 4th December, paying particular attention to the settling pond, but saw nothing unusual, nor had the pond the appearance of having recently been emptied. From inquiries which he made, however, it seemed that no dead fish had been found above this point.

David Powrie, water-bailiff on the lower part of the river, said that from the appearance of the fish it seemed that death had resulted from the same cause on both occasions. On the first occasion there was nothing abnormal in the state of the water on the lower part of the river. The dead fish, however, appeared to have been carried down from above, and not to have been poisoned in that part of the river. On the 2nd December the poison extended lower down the river, and on his beat the water smelt strongly of tar and paraffin oil, and had an exceedingly disagreeable taste. He noticed that a similar smell was emitted from the settling pond at the Dalmellington Iron Works when he inspected it on the 19th December. He could not account for the destruction of fish in December, unless it were caused by a discharge of poisonous matter from these works, as in October.

Robert Cunningham, forester, noticed nothing peculiar in the river on the 18th October, at Doonside, which is situated about a mile from the sea. It also appeared to him, however, that the dead fish were carried down from the upper part of the river, and were left stranded on the banks as the flood water subsided. On the 3rd December he noticed that the river had a disagreeable smell and taste. When he subsequently visited the Dalmellington Iron Company's works, he noticed that a similar smell proceeded from a ditch leading from the settling pond.

Mr Thomas Smith, factor to the Marquess of Ailsa, said that he had inquired carefully into the matter, and found that, although the Dalmellington Iron Company did not admit that any deleterious matter had escaped from their works on the second occasion, there was no other work from which similar matter could proceed, and the evidence he had collected all went to show that it was similar matter which had caused

the destruction of fish on both occasions. The inquiries made by Mr Dunlop of Doonside, and Mr Alexander Loudon, Solicitor, Ayr, had led to the same result.

Mr Hammond, occupier of the Skeldon Mills, said there had been no escape of waste refuse from his settling pond to which the destruction of fish on either occasion could be attributed.

I was unable to form any opinion as to the cause of death from the description, given by the water-bailiffs, of the appearance of the fish, as such descriptions are necessarily vague; but it seems, at any rate, certain that it was not due to fungus (*Saprolegnia ferax*). The greater weight of evidence goes to show that death was due to poisoning, and this was further confirmed by my inspection of the Dalmellington Iron Company's premises. It was admitted that the liquid in the settling pond was poisonous, and that the escape of this liquid into the river was coincident with the first destruction of fish. It was further stated by Mr Gavin that after the destruction of fish on the 16th October, the same liquid was forced through pipes to an open iron tank at a higher level. It is clear, therefore, that an escape of liquid from the tank would have the same effect as the bursting of the embankment of the pond. It appeared probable that such an escape had taken place as the ground immediately below the tank was furrowed into channels, which left no doubt that some liquid matter had flowed over it. I must, however, add that John King had not noticed this when he inspected the premises on the 4th December; but as his attention was directed chiefly to the settling pond and he did not recollect whether he had visited this part of the premises or not, I am unable to attach much importance to the fact of his not having seen it. In conclusion I may add that there seems to have been no destruction of fish since December. The last dead fish was said to have been taken out of the river on the 21st December, but it had the appearance of having been dead some time. Mr Smith informed me that an arrangement was being entered into with the Dalmellington Iron Company to prevent a recurrence of the injury.

I have the honour to be,

Your obedient servant,

(Signed) WALTER E. ARCHER,
Inspector of Salmon Fisheries of Scotland.

THE FISHERY BOARD FOR SCOTLAND,
EDINBURGH, 12*th January* 1894.

NOTE VI.—REPORT BY THE INSPECTOR OF SALMON FISHERIES ON A PETITION FROM THE EARL OF GALLOWAY PRAYING FOR THE EXTENSION OF THE ANNUAL CLOSE TIME IN THE DISTRICT OF THE RIVER BLADENOCH.

In accordance with the instructions received at the meeting of the Board on the 12th instant, I have the honour to submit, for the information of the Board, the following report on a petition by the Earl of Galloway to the Secretary of Scotland, praying for an alteration of the annual close time in the district of the river Bladenoch.

Under the 9th section of the Salmon Fisheries (Scotland) Act of 1868 (31 & 32 Vict. cap. 123), sub-section 1, it is competent for any district board at any meeting, of which due notice has been given by advertisement, at least ten days previously, in a newspaper printed or circulated in the county or counties in which the district is situated, to resolve to petition the Secretary of State, whose place is now occupied, as regards the fisheries, by the Secretary of Scotland, to vary, *inter alia*, the annual close time in any district, provided such annual close time shall always be one hundred and sixty-eight days. It is further provided under the 19th section of the Salmon Fisheries (Scotland) Act (25 & 26 Vict. cap. 97), that in any district where there is only one proprietor, such a proprietor may exercise all the powers of a district board. It seems, therefore, that the present petition can only be entertained in the event of the Earl of Galloway being the sole proprietor in the district of the river Bladenoch.

The limits of the district of the river Bladenoch, as defined by bye-law given under the hands of the Commissioners appointed under the Salmon Fishery (Scotland) Acts, 1862 and 1868, are :—On the west, Gillespie River; on the east, Bishop's Burn; and the district consists of the portions of the sea coast and the estuary and the river contained between the said points. It appears from a list of the salmon fisheries furnished by the county clerks from the valuation roll of the county of Wigtown, that the Earl of Galloway is not the sole proprietor of salmon fisheriet within this district, and that his petition, therefore, under the present state of the law, cannot be entertained.

I have the honour to be,

Your obedient servant,

(Signed) WALTER E. ARCHER.
Inspector of Salmon Fisheries of Scotland.

THE FISHERY BOARD FOR SCOTLAND,
EDINBURGH, 19*th February* 1894.

NOTE VII.

ANNUAL CLOSE TIME APPLICABLE TO THE SCOTCH SALMON RIVERS.

N.B.—Observe that, in the following List, the days fixing the commencement and termination of the Annual Close Time and of the Extension of Time for Rod-fishing are in all cases inclusive, as in the case of the Add, the first river in the List.

Name of River.	Annual Close Time.	Extension of Time for Rod-fishing.
Add,	From Sept. 1 to Feb. 15, both days inclusive.	From Sept. 1 to Oct. 31, both days inclusive.
Aline,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Alness,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Annan,	From Sept. 10 to Feb. 24.	From Sept. 10 to Nov. 15.
Applecross,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Arnisdale (*Loch Hourn*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Awe,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Aylort (*Kinloch*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Ayr,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Baa and Glencoilleadar,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Badachro and Kerry (*Gairloch*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Balgay and Shieldag,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Beauly,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 15.
Berriedale,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Bervie,	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Bladenoch,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Broom,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Brora,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Carradale (*in Cantyre*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Carron,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Clayburn, Finnisbay, Avennangeren, Strathgravat, North Lacastile, Scalladale and Mawrig (*East Harris*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Clyde and Leven,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Conon,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Cree,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Creed or Stornoway, and Laxay (*Island of Lewis*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Creran (*Loch Creran*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Crowe and Shiel (*Loch Duich*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Dee (*Aberdeenshire*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Dee (*Kirkcudbright*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Deveron,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Don,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Doon,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Drummachloy or Glenmore (*Isle of Bute*),	From Sept. 1 to Feb. 15.	From Sept. 1 to Oct. 15.
Dunbeath,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 15.
Earn,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Eckaig,	From Sept. 1 to Feb. 15.	From Sept. 1 to Oct. 31.
Esk, North,	From Sept. 1 to Feb. 15.	From Sept. 1 to Oct. 31.
Esk, South,	From Sept. 1 to Feb. 15.	From Sept. 1 to Oct. 31.
Ewe,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.

Name of River.	Annual Close Time.	Extension of Time for Rod-fishing.
Fincastle, Meaveg, Ballanachist, South Lacastile, Borve, and Obb (*West Harris*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Findhorn,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 10.
Fleet (*Sutherlandshire*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Fleet (*Kirkcudbrightshire*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Forss,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Forth,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Fyne, Shira, and Aray (*Loch Fyne*),	From Sept. 1 to Feb. 15.	From Sept. 1 to Oct. 31.
Girvan,	From Sept. 10 to Feb. 14.	From Sept. 10 to Oct. 31.
Glenelg,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Gour,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Greiss, Laxdale, or Thunga,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Grudie or Dionard,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Gruinard and Little Gruinard,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Halladale, Strathy, Naver, and Borgie,	From Aug. 27 to Feb. 10.	Close time for rod-fishing from Oct. 1 to Jan. 10.
Helmsdale,	From Aug. 27 to Feb. 10.	Close time for rod-fishing from Oct. 1 to Jan. 10.
Hope and Polla or Strathbeg,	From Aug. 27 to Feb. 10.	From Jan. 11 to Feb. 10, and from Aug. 27 to Sept. 10.
Howmore,	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Inchard,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Inner (*in Jura*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Inver,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Iorsa (*in Arran*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Irvine and Garnock,	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Kennart,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Kilchoan or Inverie (*Loch Nevis*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Kinloch (*Kyle of Tongue*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Kirkaig,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Kishorn,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Kyle of Sutherland,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 15.
Laggan and Sorn (*Island of Islay*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Laxford,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Leven,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Little Loch Broom,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Lochy,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Loch Duich,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Loch Luing,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Loch Roag,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Lossie,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 15.
Luce,	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Lussa (*Island of Mull*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Moidart,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Morar,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Mullanageren, Horasary, and Lochnaciste (*North Uist*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Nairn,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Nell, Feochan, and Euchar,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Ness,	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 15.
Nith,	From Sept. 10 to Feb. 24.	From Sept. 10 to Nov. 14.
Orkney Islands (*River from Loch of Stenness, &c.*),	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Ormsary (*Loch Killisport*), Loch Head, and Stornoway (*Mull of Cantire*),	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.

Name of River.	Annual Close Time.	Extension of Time for Rod-fishing.
Penygowan or Glenforsa, and Aros, . . .	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Resort, ...	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Ruel, ...	From Sept. 1 to Feb. 15.	From Sept. 1 to Oct. 31.
Sanda, ...	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Scaddle, ...	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Shetland Islands (*River of Sandwater, &c.*), . .	From Sept. 10 to Feb. 24.	From Feb. 1 to Feb. 24, and from Sept. 10 to Nov. 15.
Shiel (*Loch Shiel*), . .	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Sligachan, Broadford, and Portree (*Isle of Skye*), :	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Snizort, Orley, Oze, and Drynoch (*Isle of Skye*), .	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Spey, ...	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 15.
Stinchar, ...	From Sept. 10 to Feb. 24.	From Sept. 10 to Nov. 15.
Tay, ...	From Aug. 27 to Feb. 10.	From Jan. 15 to Feb. 10, and from Aug. 27 to Oct. 15.
Thurso, ...	From Aug. 27 to Feb. 10.	From Jan. 11 to Feb. 10, and from Aug. 27 to Sept. 14.
Torridon, Balgay, and Shieldag, . . .	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Ugie, ...	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.
Ullapool (*Loch Broom*), .	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Urr, ...	From Sept. 10 to Feb. 24.	From Sept. 10 to Nov. 30.
Wick, ...	From Aug. 27 to Feb. 10.	From Aug. 27 to Oct. 31.
Ythan, ...	From Sept. 10 to Feb. 24.	From Sept. 10 to Oct. 31.

NOTE VIII.

LIST OF CHAIRMEN AND CLERKS OF SALMON FISHERY DISTRICT BOARDS, with their Addresses. Based on information obtained by Circular from Sheriff-Clerks, &c., in obedience to request from Secretary for Scotland.

DISTRICT.	CHAIRMAN.		CLERK.	
	Name.	Address.	Name.	Address.
Alness, . . .	Col. J. C. Warrand,	Ryefield House, Conon Bridge, by Dingwall.	William J. Duncan, Esq.,	Solicitor, Dingwall.
Annan, . . .	A. Johnstone Douglas, Esq.,	Comlongan Castle, Ruthwell, Dumfries.	J. F. Cormack, Esq.,	Writer, Lockerbie.
Awe, ...	Marquis of Breadalbane,	Taymouth Castle.	Alex. M'Arthur, Esq.,	Solicitor, Oban.
Balgay, . . .	C. R. Manners, Esq., C.E.,	12 Lombard St., Inverness.	Duncan Shaw, Esq., W.S.,	42 High Street, Inverness.
Bervie, . . .	James Farquhar, Esq., of Hallgreen, per his factor Patrick Dickson,	Solicitor, Laurencekirk.	Arthur Dickson, Esq.,	Solicitor, Montrose.
Conon, . . .	Major J. F. H. Stewart Mackenzie, of Seaforth, per Sir J. D. Brodie, W.S.,	5 Thistle St., Edinburgh.	Edmund J. Gunn, Esq.,	Solicitor, Dingwall.
Cree, ...	James Drew, Esq., of Craigencallie,	Newton-Stewart.	A. B. Matthews, Esq.,	Writer, Newton-Stewart.
Dee (Solway), .	H. G. Murray Stewart, Esq., of Broughton,	Gatehouse.	W. Nicholson, Esq.,	Sheriff - Clerk, Kirkcudbright.
Dee (Aberdeen),	Lord Provost of Aberdeen,	Aberdeen.	Thomas Wilsone, Esq.,	Solicitor, Aberdeen.
Deveron, . .	A. F. Leslie, Esq., of Montcoffer,	Banff.	F. George, Esq.,	Writer, Banff.
Don, ...	Vacant.	...	Thomas Wilsone, Esq.,	Solicitor, Aberdeen.
Esk (North), .	Rev. J. S. More Gordon, of Charleton and Kinnaber,	Vicar of St John's, Redhill, Surrey.	Arthur Dickson, Esq.,	Solicitor, Montrose.
Esk (South), .	James Johnston, Esq.,	Montrose.	James Don, Esq.,	Writer, Brechin.
Findhorn, . .	J. G. Littlejohn, Esq., factor for R. C. Munro - Ferguson, Esq., M.P.,	Kirkcaldy, Fifeshire.	W. Grant, Esq.,	National Bank Buildings, Forres.
Forth, . . .	Mandatory of Commissioners of Woods and Forests,	...	T. L. Galbraith, Esq.,	Town-Clerk, Stirling.
Girvan, . . .	Earl of Stair,	Lochinch, Wigtownshire.	William Murray, Esq.,	Writer, Girvan.
Kyle of Sutherland,	William Anderson, Esq., factor for Balnagown,	Parkhill, Rossshire.	John Leslie, Esq.,	Solicitor, Dornoch.
Lochy, ...	Lord Abinger,	Inverlochy Castle, Kingussie.	N. B. Mackenzie, Esq.,	Writer, Fort William.
Nairn, . . .	Brodie of Brodie,	Brodie Castle, Forres.	H. T. Donaldson, Esq.,	Writer, Nairn.
Ness, ...	George Malcolm, Esq.,	Invergarry, Fort Augustus.	A. Macdonald, Esq.	Writer, 51 Church St., Inverness.
Nith, ...	A. Johnstone Douglas, Esq.,	Comlongan Castle, Ruthwell, Dumfries.	C. Stewart Phyn, Esq.,	Writer, County Buildings, Dumfries.
Spey, . . .	Duke of Richmond and Gordon,	Gordon Castle, Fochabers.	Cooper & Wink,	Solicitors, Elgin.
Stinchar, . .	Vacant.	...	T. C. Greig, Esq.,	Rephad, Stranraer.
Tay, ...	The Hon. F. J. Moncrieff, as *Curator Bonis* of Edward Paterson Balfour Hay, Esq., of Mugdrum and Carpow, Perthshire,	46 Castle St., Edinburgh.	Mackenzie & Dickson,	Writers, Perth.
Torridon, . .	C. R. Manners, Esq., C.E.,	12 Lombard St., Inverness.	Duncan Shaw, Esq., W.S.,	42 High St., Inverness.
Ugie, . . .	Lieut.-Col. George A. Ferguson, of Pitfour,	Mintlaw.	William Boyd, Esq.,	Solicitor, Peterhead.
Urr, ...	John G. Mackie, Esq., of Auchencairn,	Castle-Douglas.	W. Nicholson, Esq.,	Sheriff - Clerk, Kirkcudbright.
Ythan, . . .	Earl of Errol,	Slains Castle, Aberdeenshire.	D. M. A. Chalmers, Esq.,	18 Golden Square, Aberdeen.
Tweed Commissioners,	Sir William Crossman,	Cheswick House, Beal, Northumberland.	James Tait, Esq., W.S.	Kelso.

Note.—In addition to the districts specified above, the Duke of Sutherland is sole proprietor of the districts of the following rivers, viz.:—Helmsdale, Brora, Fleet (under the charge of his factor, Mr Donald M'Lean, Dunrobin Office, Golspie); Kirkaig, Inver, Laxford, Inchard, and Grudie or Dionard (under the charge of his factor, Mr Evander M'Iver, Scourie, by Lairg); Halladale, Strathy, Naver and Borgie, Kinloch, Hope, and Polla or Strathbeg (under the charge of his factor, Mr John Box, Tongue, Sutherland), and the Earl of Cromartie is sole proprietor of the district of the river Kennart (under the charge of his factor, Mr William Gunn, Cromartie Estate Office, Strathpeffer).

NOTE IX.

NATURAL HISTORY NOTES IN NORWAY. By Mr W. E. Archer, F.R.S.E., Inspector of Salmon Fisheries of Scotland.

Under the above heading, in Note II. of the Appendices to the Eleventh Annual Report of the Fishery Board for Scotland, I gave a description of my fishery at Sand in Norway; in which I showed, amongst other matters, how it was conducted previous to my leasing it, the means taken to improve it, and the results. These subjects will be found fully discussed in that paper, and the only additional information which I propose to give, in the present paper, are the statistics for the year 1892. It may, however, be worthy of note that the success which has apparently attended the measures taken for the improvement of the fisheries at Sand, has lead, since 1888, to similar measures being adopted on ten other rivers falling into the same or neighbouring fjords. These statistics are derived from the sources and subject to the qualifications stated last year.

Year.	Yield of Sand's River.	Average of 4 Years.	Yield of Bagnets.	Average of 4 Years.	Number of Bag-nets.	Average Yield per Net.	Average Yield per Net.	Remarks.
	lbs.	lbs.	lbs.	lbs.		lbs.	lbs.	
1880	3,410		20,620		97	212		Fixed engines in river and sea, fishing 6 days a week.
1881	6,402		28,010		85	329		
1882	6,635		13,103		72	182		Fixed engines in river and sea, fishing 4 days a week.
1883	6,701	5,787	21,934	20,917	76	288	253	
1884	3,212		23,729		82	289		
1885	6,170		48,859		107	455		
1886	4,478		39,371		108	364		
1887	5,626	4,871	35,483	36,860	149	238	336	Angling in river. Bag-nets in sea, fishing 4 days a week.
1888	4,231		52,353		180	290		
1889	2,697		48,336		172	281		
1890	3,638		35,492		165	215		
1891	5,873	4,110	94,292	57,618	209	451	309	
1892	3,146		80,964		229*	354		

* In the returns furnished to me, the number of nets fishing in two parishes is not given. There were, however, on an average, eight nets fishing in these parishes during the previous four years. I have estimated, therefore, that there were the same number in 1892.

TWELFTH

ANNUAL REPORT

OF THE

FISHERY BOARD FOR SCOTLAND,

Being for the Year 1893.

IN THREE PARTS.

PART I.—GENERAL REPORT.
PART II.—REPORT ON SALMON FISHERIES.
PART III.—SCIENTIFIC INVESTIGATIONS.

PART III.—SCIENTIFIC INVESTIGATIONS.

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1894.

CONTENTS.

PAGE

General Statement 7

The Hatching and Rearing of Food-Fishes 8
The Inadequacy of the Present Limit of the Territorial Waters . 11
The Influence of Beam-Trawling 12
The Trawling Experiments of the 'Garland' 12
Further Observations on Trawling and the Fisheries . . 15
Scottish Mackerel Fishing 16
Seine-Net Fishing for Herrings at Ballantrae Bank . . 18
The Capture of Immature Fish by the Beam-Trawl . . 18
The Life-Histories and Development of the Food and other Fishes 19
The Pelagic Fauna and the Rate of Growth of the Food-Fishes . 20
Physical Observations 21
Contemporary Fishery Work 21

SECTION A.—GENERAL REPORTS.

I. Report on the Trawling Experiments of the 'Garland,' and on the Statistics of the East Coast Fisheries relating thereto. —Part VIII. 23
i. Introductory 23
ii. The Work of the 'Garland' 24
1. The Firth of Forth 24
2. St Andrews Bay 25
3. The Moray Firth 27
4. The Firth of Clyde 28
iii. Special Statistics of Fish caught by Line Fishermen and Beam-Trawlers 28
1. Relative Quantities of Fish taken by Line and Beam-Trawl 28
2. Statistics showing the Quantities of Line-caught Fish obtained from Territorial Waters . . . 30
3. Buckhaven Haddock and Cod Line Fishing . . 31

PAGE

iv. Summary 32
Table A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1893 35
Table B.—Analysis of the 'Garland's' Statistics relating to the relative Abundance of Fish 42
Table C.—Record of Observations made on Board the 'Garland' on the East Coast 45
Table D.—Buckhaven Haddock and Cod Line Fishing . 142
Table E.—Showing the Monthly Takes of Line and Net Boats from Inshore Grounds in the Leith, Anstruther, Montrose, and Stonehaven Districts 143
Table F.—Showing the Quantities of Fish (in cwts.) captured by Line Fishermen in the Territorial Waters of certain Districts, with the Average per 'shot' in 1891, 1892 and 1893 161
Table G.—Showing the Quantities monthly of Large and Small Fish landed in Aberdeen District by Beam-Trawlers and Line Fishermen in 1893 162
Table H.—Showing the Monthly Amounts in cwts. of Round and Flat Fish landed by Line Fishermen and Beam-Trawlers on the East Coast of Scotland during 1893 . 164

II. Remarks on Trawling. By Professor M'Intosh, M.D., LL.D., F.R.S., &c. First Series 165
1. General Remarks 165
2. Changes in the Trawling-Vessels and their Apparatus . 169
3. The Present State of the Beam-Trawl Fishery in relation to the Fishing-Grounds and the Fishes . . . 176
4. Effect of Trawling on the Invertebrate Fauna on the Sea-Bottom (forming Fish Food), and Collateral Relations with Pelagic Life 184
5. Effects of the Hooks of the Liners on the same Ground . 191
6. Effects of the Trawl on the Eggs of Fishes, on certain Ground-Fishes, and very Young Fishes on the Bottom . 193

III. An Account of the Sea-Fish Hatchery at Dunbar. By Dr T. Wemyss Fulton, F.R.S.E., Superintendent of Scientific Investigations. (Plate I.) 196
1. The Spawning Pond 196
2. The Pumping Apparatus 198
3. The Spawn-Collecting and Filtering Chamber . . 199
4. The Hatching House 201
5. The Tidal Pond 202
6. The Work at the Hatchery 203
7. The Treatment of the Fry 208
8. The Capacity of the Hatchery 208

IV. On the Hatching Operations at Dunbar Marine Hatchery during the Spring-Season, 1894. By Harald Dannevig, of the Marine Hatchery, Flödevig . . 210

PAGE
1. The Spawners in the Pond 210
2. The Hatching Operations 211

SECTION B.—BIOLOGICAL INVESTIGATIONS.

I. Contributions to the Life-Histories and Development of the Food and other Fishes. By Professor M'Intosh, M.D., LL.D., F.R.S., F.R.S.E., &c., St Andrews Marine Laboratory. (Plates II.–IV.) 218
1. Additional Observations on the Eggs of the Green Cod or 'Saithe' 218
2. On the Ova and Larva of the Turbot 222
3. On an Unknown Egg with an Oil-Globule resembling that of the Sail-Fluke 224
4. On *Lumpenus lampetræformis*, Walb. 225
5. On the Norwegian Topknot, *Rhombus* (*Zeugopterus norvegicus*) 227

II. Additions to the Fauna of the Firth of Forth. Part VI. By Thomas Scott, F.L.S. (Plates V.–X.) 231

III. On the Skeleton of the Tunny. By Arthur T. Masterman, B.A. (Cant.), University-Assistant and Lecturer in Natural History, University of St Andrews. (Plates XI., XII.) . 272

IV. The Invertebrate Fauna of the Inland Waters of Scotland. —Part IV. By Thomas Scott, F.L.S. 284

V. Notes on the Physiology and Pathology of Fishes. By George Sandeman, M.A., F.Z.S., of the Marine Laboratory, St Andrews 291

VI. List of some of the Pelagic Ova, Larvæ, and Young Fishes obtained by the s.s. 'Garland' and Boat 'Dalhousie' in 1894. By H. C. Williamson, M.A., B.Sc., and James R. Tosh, M.A., B.Sc., St Andrews Marine Laboratory 298

VII. The Capture and Destruction of Immature Sea Fish. Part III. The Relation between the size of the Mesh of Trawl-Nets and the Fish captured. By Dr T. Wemyss Fulton, F.R.S.E., Superintendent of Scientific Investigations 302

VIII. On the Oviposition and Growth of the Lesser Sand-Eel. By J. H. Fullarton, M.A., D.Sc., F.R.S.E. 313

IX. On the Anatomy of the Pectoral Arch of the Grey Gurnard. By H. C. Williamson, M.A., B.Sc. (Plates XIII.–XV.) . 322

X. On the Rate of Growth of Certain Marine Fishes. By James R. Tosh, M.A., B.Sc., Fisheries' (Woodall) Prizeman, University of St Andrews 333

SECTION C.—PHYSICAL OBSERVATIONS.

Report on Physical Investigations carried out on Board H.M.S. 'Jackal,' 1893–94. By H. N. Dickson, F.R.S.E., F.R.G.S. (Plates XVI.–XIX.) 336

PAGE

SECTION D.—CONTEMPORARY WORK.

An Account of Contemporary Scientific Fishery Work and Fisheries in this and other Countries. By Dr T. Wemyss Fulton, F.R.S.E., Superintendent of Scientific Investigations 383

	PAGE		
United Kingdom . .	384	Denmark . . .	399
Canada	390	Holland . . .	400
New South Wales . .	393	France	402
United States . . .	393	Spain	403
Sweden	395	Russia	404
Norway	398		

INDEX. 405

TWELFTH ANNUAL REPORT.

TO THE RIGHT HONOURABLE

SIR GEORGE O. TREVELYAN, BART.,

Her Majesty's Secretary for Scotland.

OFFICE OF THE FISHERY BOARD
FOR SCOTLAND,
EDINBURGH, 1*st June* 1894.

SIR,

In continuation of our Twelfth Annual Report, we have the honour to submit—

PART III.—SCIENTIFIC INVESTIGATIONS.

GENERAL STATEMENT.

This part of the Twelfth Annual Report deals with the Scientific Investigations carried on by the Board in 1893 in connection with the sea and other fisheries. An account is also given of the scientific fishery work and the fishery regulations in other countries possessing sea fisheries, and of the principal means being taken to protect and develop them.

In the course of 1893 the investigations, which were carried out under the supervision of Dr T. Wemyss Fulton, the Superintendent of Scientific Investigations, were prosecuted on the same general lines as in previous years, and have resulted in further extensions of knowledge respecting the life-histories and habits of the fishes which form the basis of the fishery industry, and of the operations of certain methods of fishing in relation to the food supply. Besides such enquiries, which are necessary for the proper conservation and regulation of sea fisheries, an important addition to the resources of the department was made by the completion at Dunbar of a hatchery for the artificial propagation of the food-fishes, such as soles, turbot, and plaice, and capable of producing in the course of a year over a hundred millions of their fry. Similar establishments have been in use for a number of years in the United States, Norway, Canada, and Newfoundland.

A large part of the scientific enquiries, both biological and physical, have been made by means of the 'Garland,' the small

steam-vessel belonging to the Board; but, as has been mentioned in previous reports, her small size and consequent unseaworthiness have considerably curtailed the extent and usefulness of the investigations. The 'Garland,' which was bought by the Board in 1886, was originally a pleasure yacht. Her registered tonnage is 36·4 tons, her length 84 feet 7 inches between perpendiculars, breadth 15 feet, and depth 8 feet 5 inches; her utmost speed is between 8 and 9 knots an hour, while an ordinary steam-trawler goes from 10 to 12 knots, and she is only adapted to carry a 25-feet beam-trawl.

In consequence of the inability of the 'Garland' to face anything but moderate weather, or venture far from land, the work has been practically restricted to limited portions of the territorial waters and certain firths and bays. It has not been possible to carry on adequate investigations as to the results of the prohibition of beam-trawl fishing in the Moray Firth and the Firth of Clyde, and in other parts of the waters (amounting to about 7000 square miles) within which this mode of fishing has been made illegal; nor to extend the enquiries, which have already yielded valuable results in the inshore waters, to the breeding grounds situated at some distance from the shores, which form the great source of fish-supply to the territorial seas. Were the 'Garland' replaced by an efficient sea-going vessel of the type recommended by the Parliamentary Committee on Sea-Fisheries, capable of visiting the fishing grounds in weather when trawlers and fishing-boats can carry on their work, it would be possible to push on the investigations referred to, and to prevent in a manner much more satisfactory than at present the alleged depredations of trawlers within the closed waters.

Part of the scientific work was also carried on at the marine laboratories at St Andrews and Dunbar; at the latter on the oviposition and growth of the sand-eel, and at the former, under the direction of Professor M'Intosh, F.R.S., on the eggs, larvæ, and development of a number of the food-fishes, on the rate of growth of fishes, the distribution of pelagic eggs, &c. These are referred to more fully below.

Physical observations on the temperature and density of the sea have been made daily at ten fixed stations—five on the East Coast and five on the West Coast—and on board the 'Garland,' the 'Vigilant,' and H.M.S. 'Jackal.'

The Board also took part in an international hydrographic survey of the North Sea, designed for the purpose of ascertaining, as far as possible, the relations between the varying physical conditions of the sea and the movements of fish-shoals—the observations on this side being made along various lines from the Moray Firth to the Farŏe Isles. The other countries which participated in the survey were Germany, Sweden, Norway, and Denmark.

The Hatching and Rearing of Food-Fishes.

The diminution in the supply of the larger and more valuable flat-fishes, such as turbot, plaice, and lemon soles, has been referred to in previous reports. In consequence of complaints in regard to the growing scarcity of the better classes of flat-fishes in

the North Sea, a Committee of Parliament, of which the Right Hon. E. Marjoribanks, now Lord Tweedmouth, was chairman, was appointed last year to consider the matter, and they found that from the evidence of all those interested, 'whether trawlers or 'linesmen, whether smack owners or fishermen, whether scientific experts or statisticians, there seems to be no doubt that a con-'siderable diminution has occurred amongst the more valuable 'classes of flat-fish, especially among soles and plaice, and that this 'diminution must be attributed to over-fishing by trawlers in 'certain localities.' Such diminution in the supply of certain kinds of the food-fishes in relation to the increased means of capturing them is not peculiar to the Scottish or British coasts. Complaints have for many years been made in almost all countries where sea-fisheries are extensively prosecuted of depletion of the fishing-grounds in the neighbourhood of the coasts, and active measures by restrictive regulations and the artificial propagation of the food-fishes have in many instances been taken.

In Scotland the regulative measures respecting beam-trawling, the mode of fishing by which flat fishes are principally obtained, have been more extensive than in any other country, and have been longer in force. In 1886 and subsequent years beam-trawl fishing was prohibited for experimental purposes in the Firth of Forth, St Andrews Bay, and the greater part of the territorial waters on the East Coast; and in 1889, by the Herring Fishery (Scotland) Act, practically the whole of the territorial waters, and also some bays and firths, which extend beyond the territorial limit (such as the Firth of Clyde and the Moray Firth) were closed to this mode of fishing. Although the area of fishing-ground from which beam-trawlers have been thus excluded is very large, it cannot be said, with the information at present available, that these measures have had the results that were anticipated. Statistics show a continued falling off in the supplies of flat-fishes, and the trawling investigations of the 'Garland' in the Firth of Forth and St Andrews Bay also indicate a general diminution in their average abundance within these protected waters.

One of the means which have been adopted in several countries to deal with the depletion of inshore fisheries consists in the stocking of the exhausted grounds with multitudes of fry hatched in sea-fish hatcheries, and the Board, in carrying out the same policy, have recently completed a hatchery at Dunbar. The establishment was completed in the spring of the present year, and operations in the hatching of the more valuable flat-fishes have been in active progress since that time, under the supervision of Mr Harald Dannevig, an expert from the Norwegian hatchery, whose services have been obtained for the purpose. Dunbar was selected as a suitable site for several reasons; the most important of which were that the water was found to be of good quality for the hatching of buoyant fish-eggs, and that natural sea-creeks, well adapted to form tidal ponds for the collection of the brood-fish and the rearing of the fry existed in the neighbourhood. The hatchery consists of—(1) the hatching-house, in which the special boxes for hatching the eggs are placed; (2) the spawning-pond, which contains the spawning-fishes when the work is going on; (3) the

chamber in which the fish-eggs are collected, and the water which supplies the hatching-house is filtered; (4) the house containing the pumps and boiler; (5) the tidal-pond to serve for the retention of the spawners or brood-fish until the actual hatching work begins, and thereafter as a reservoir of filtered water for the hatchery. A detailed description of the establishment, by Dr T. Wemyss Fulton, and an account of the hatching operations with the plaice by Mr Harald Dannevig, will be found in the present report.

The spawning-pond is constructed of concrete, sunk in the ground, and is capable of containing over 10,000 cubic feet of water, or about 62,000 gallons; it is covered in by an erection of wood and galvanised iron. The adult fishes (males and females) are placed in this pond at the spawning season, and a constant circulation of sea-water is maintained through it. The fishes spawn naturally, as they would in the sea, and the fertilised eggs, which are buoyant, float towards the surface, and are carried by the overflow into a compartment with haircloth walls, which acts as a sieve, and retains the eggs while the water flows away. The eggs are then transferred to the hatching-boxes in the hatching-house, where they are subjected to a constant current of pure sea-water until they hatch. The fry are retained for a varying period until the yolk-sac, from which they derive their nourishment in the early stage, is nearly exhausted, and they are able to feed. They are thereafter transferred to suitable places in relation to the fishing-grounds, where they are liberated. The supply of sea-water for the establishment is obtained by means of two double-acting steam-pumps, capable of throwing over 7000 gallons per hour, and driven by an eight-horse power boiler.

At the sea-fish hatcheries in the United States, Norway, and Newfoundland, the species of food-fish which has been principally dealt with is the cod, which forms a very important element in the fisheries of these countries. But for the reasons above adverted to, it was decided to begin operations at Dunbar by hatching the more valuable flat-fishes, namely, plaice, soles, turbot, and lemon soles. The plaice, which is the earliest of the flat-fishes to spawn, was first dealt with; but, as the hatchery was not sufficiently completed to allow operations to be begun until early in March, it was not possible to take full advantage of the spawning of this species, the spawning season beginning in January.

Eggs of this species were collected from the spawning-pond between 9th March and 8th May, the total number obtained during this time being 27,250,000, and the number of fry successfully hatched was 26,060,000, all of which were transferred to the waters of the Firth of Forth, St Andrews Bay, and off Dunbar, by the 'Garland.' The proportion of the eggs of the plaice which succumbed in the process of hatching was, therefore, very low, being about 4·4 per cent. for the whole season. The temperature of the water varied from about 4·5° C., at the commencement of the work, to nearly 9° C. at the beginning of May; and the duration of incubation varied accordingly from twenty-one to fourteen days. The specific gravity of the water was high and very constant, the average being a little

more than 1027. Had it been possible to begin the work early enough to include in the operations the whole of the spawning period of the plaice, and to stock the spawning-pond to its full capacity, three or four times the number of plaice eggs might have been obtained.

Besides dealing with the plaice, 500,000 cod eggs were hatched, and arrangements were also made to obtain supplies of adult soles, turbot, and lemon soles, to be used as brood fish for the production of eggs, the spawning season of these species being much later than that of the plaice. Owing to the insufficient size of the small tidal pond, which is the only one at present available, it was not practicable gradually to collect these fishes in numbers, as is done with the fish to be used as spawners at other hatcheries. By the courtesy of the Lancashire Sea-Fisheries Committee, a number of careful trawlings were made by their scientific steamer, the 'John 'Fell,' on the sole-grounds between the Lancashire Coast and the Isle of Man, and the selected soles thus procured were brought from Fleetwood to Dunbar. Turbot were also procured, chiefly from the set-nets on the Ayrshire coast, and likewise a large number of lemon-dabs. The soles, turbot, and lemon-dabs thus obtained are now being dealt with at the hatchery, and it is anticipated that during the present year considerable numbers of the fry of these valuable species will be placed on the inshore fishing-grounds.

The first year's work at the hatchery has so far been very satisfactory. The boiler, pumps, and all the apparatus have been in continuous use without any hitch occurring; and the water proved to be eminently suitable for the purpose.

In addition to the operations at Dunbar, about 600,000 lobster eggs were hatched at the lobster-pond at Brodick, making a total of 27,160,000.

The Inadequacy of the Present Limit of the Territorial Waters.

In last year's report it was pointed out that the present limit of the territorial waters, namely, three miles from low-water mark, is insufficient for the proper conservation and regulation of the sea fisheries, and it was suggested that if jurisdiction were extended to ten or twelve miles from the shore, it would enable the fisheries to be brought under more effective control, either by the protection of defined areas during the spawning-period, or otherwise, as might be found most suitable for the purpose. This view has been recognised and endorsed by the recent Parliamentary Committee on Sea-Fisheries, who, in their report, say that 'the 'best method for effectively governing the operations of the 'various classes of fishermen, and, at the same time, for securing, 'so far as it may be found possible, the proper protection of 'spawning and immature fish, would be to throw the responsibility 'of these duties, so far as the waters immediately adjacent to the 'various countries are concerned, on those various countries; that, 'for the effective realisation of this object,, the present territorial 'limit of three miles is insufficient, and that, for fishery purposes

'alone, this limit should be extended, provided such extension can 'be effected upon an international basis, and with due regard to 'the rights and interests of all nations.' They, accordingly, 'earnestly recommend that a proposition on these lines should 'be submitted to an international conference of the powers who 'border on the North Sea.'

A similar opinion on the inadequacy of the present territorial limit was expressed by the Institute of International Law at their annual convention held a few months ago, and attended by the leading publicists and authorities on international law from the various countries in Europe, including all those which border the North Sea. The resolutions adopted by this important body include the following:—'That the distance most generally 'adopted, of three miles from low-water mark, has been found 'insufficient for the protection of the littoral fishery'; and that 'the territorial sea should extend to six marine miles (60 to a 'degree of latitude) from low-water mark along the whole extent 'of the coast,' following its sinuosities, except in bays where the distance from shore to shore along a straight line is less than 12 miles—the limit of the territorial water in such a case to be 6 miles seaward from this line.

While the Parliamentary Committee do not express any opinion as to the precise limit which should be adopted, leaving that for the consideration of the international conference, the Institute have placed it at 6 miles, or just double what it is at present. There is little doubt, however, that a limit of 6 miles will be insufficient for fishery purposes. It may be enough for the exercise of police regulations for the maintenance of order, but it will not include the most important breeding places of the food-fishes, nor the chief nurseries of the young fishes in the North Sea; and it will not, therefore, permit that effective control over such fishing-grounds, which the Parliamentary Committee desiderate, and which is necessary for the due protection and development of the fisheries. The scientific investigations of the Board have shown that protection of areas of considerable size—such as the Firth of Forth and St Andrews Bay—which are devoid of any important spawning-grounds, may be inoperative in increasing the abundance of the food-fishes within their waters, even although the protection embraces the whole period of the year. If the territorial waters were extended to a sufficient distance from the shore so as to include such breeding places, it would be possible to take effective measures for increasing the fish supply, and with less general interference with fishing operations than is at present the case. The assembling of an international conference to consider this question would be of great utility, not only to the sea fisheries of Scotland, but to those of the North Sea generally.

The Influence of Beam-Trawling.

The Trawling Experiments of the 'Garland.'

The results of the trawling experiments and observations of the 'Garland' respecting the relative abundance of the food-fishes in

certain parts of the territorial waters where beam-trawling is prohibited, and on the influence of this prohibition on the fish supply, are given in a special report in Section A.

The various trawling stations in the Firth of Forth and St Andrews Bay were examined, as nearly as possible once a month; those in Montrose Bay, Aberdeen Bay, and the Moray Firth on two occasions in the course of the year. The number of ordinary trawlings, or periodic examinations of the Stations in the course of the year, was 181 as against 158 in 1892.

It was not found possible, from want of means, to examine any of the stations in the Firth of Clyde, which were selected in 1887 and examined on two occasions since that year, namely, in 1888 and 1891. There is at present no evidence to show whether the closure of the Clyde area, amounting to over 600 square miles, to beam-trawlers has been beneficial to the fish supply, or to what extent it may have influenced the abundance of fishes on the fishing grounds.

In the area of the Firth of Forth and St Andrews Bay, where the trawling investigations were conducted with most regularity, the stations were examined on 126 occasions. In the Firth of Forth, where 96 hauls were made, it was found that, compared with the previous year, a considerable increase had occurred in the abundance of fish both within and without the protected waters. The increase was due principally to an increase in round fishes, and very notably of haddocks; but the average catch of flat fishes was also greater than in 1892. At the stations in the closed area the general average number of fishes of all kinds taken in each haul of the net was 287·6 last year, as against 184·4 in 1892. The average number of round fishes taken was 162·4 in 1893, while in the previous year it was only 71·3. The average number of flat fishes increased from 106·3 to 120·5; and an examination of the records show that all kinds increased except long rough dabs, turbot, and brill. At the stations outside the closed area there was a large increase in round fishes, and a less considerable increase in flat fishes. In the St Andrews Bay area the result of the examination of the various stations also showed a considerable increase in round fishes and flat fishes compared with the previous year. In the closed waters the general average per haul of the net was 148·2, as against 128·4 in 1892. The average for round fishes rose from 36·6 to 43·9; that for flat fishes from 84·0 to 102·8. At the station in the open waters the average for round fishes in 1893 was 61·5 compared with 53·6 in 1892; the average catch of flat fishes, on the other hand, fell from 50·3 to 30·5.

The trawling experiments in St Andrews Bay and the Firth of Forth have now been carried on for eight years—ever since the prohibition of beam-trawling in these waters was introduced. The quantities of fishes captured have varied within certain limits in different years, and although the results of the trawling experiments in 1893 show an increase in the abundance of fishes as compared with the year or two previous, an analysis of the records for the entire period indicates that the numbers have, on the whole, diminished since the waters were closed to beam-trawling. Taking the two areas—the Firth of Forth and St Andrews Bay—

together, the average number of flat fishes and round fishes captured in each haul of the net in the protected waters in each year are as follow:—

	Flat Fishes.	Round Fishes.	Total.
1886 .	131·1	79·6	213 9
1887 .	270·6	115·9	390·1
1888 .	163·9	80·5	248·7
1889 .	148·2	34·5	187·1
1890 .	201·9	80·9	288·0
1891 .	112·2	43·7	161·6
1892 .	95·1	53·9	156·4
1893 .	129·0	149·0	282·4

These figures indicate the fluctuations referred to above, but they also seem to indicate a fairly steady falling off in the quantity of fish caught. The very high average for round fishes in 1893 was almost entirely due to an abnormal abundance of small haddocks, which swarmed all along the East Coast in the summer and autumn; the average number of haddocks obtained in the course of the experiments in 1892 was 22·1, while last year it rose to 118·8. In order that comparison may be made between the results obtained in the first few years following the prohibition of trawling in the Firth of Forth and St Andrews Bay, and those obtained in the last few years, they have been reduced to averages as follows:—

	Flat Fishes.	Round Fishes.	Total.
1886–1889 .	178·5	77·8	260·0
1890–1893 .	134·6	81·9	222·1

As has been previously mentioned, a certain and indefinite amount of natural fluctuation, due to more or less obscure causes, such as variations in the weather, &c., must be taken into account in considering these statistics of the trawling experiments. But it is improbable that such influences will entirely explain the general falling off in the abundance of the food-fishes, and especially of flat fishes, which these figures disclose. It may, at all events, fairly be regarded as proved that the expectation that the closure to beam-trawling of these limited portions of the territorial waters would lead to a great increase in the numbers of the food-fishes within them was not well founded. The prohibition of beam-trawling has been followed by a general decrease rather than by an increase in these protected waters. As indicated in previous reports, the explanation has probably to be sought in general over-fishing in the extra-territorial waters of the district. It is in these extra-territorial waters that the important spawning-grounds are situated, and it is from them that the inshore grounds receive their normal supplies of floating fish-eggs and young fishes. It thus appears reasonable to suppose that more benefit would have been derived from protecting an extra-territorial area during the spawning season than by merely closing this portion of the territorial waters throughout the whole year.

In regard to the closure of the Moray Firth to beam-trawling, there is as yet no information to show whether this procedure has been beneficial to the fish supply, or to what extent it is likely to

be followed by an increased abundance of the food-fishes in the closed waters. Sixteen trawling stations within the limits of the Firth were examined twice last year. The number of the food-fishes, especially of flat fishes, captured on the second occasion was considerably greater than in the first series of trawlings; but the examination took place at different seasons, and no deduction can be made from this. From the immense area closed to beam-trawling throughout the whole year—comprising over 2000 square miles of the sea-bottom—and the presence within it of extensive spawning-grounds, where great shoals of the food-fishes congregate, it would be of the greatest value if a systematic examination of the fishing grounds could be made at brief intervals, a duty for which the 'Garland' is, however, but ill-fitted. Special statistics are being collected along the coasts of the Firth, in order to determine from year to year the quantities of round fishes and flat fishes captured within it by line fishermen.

Further Observations on Trawling and the Fisheries.

In the present report will be found the first part of an important paper by Professor M'Intosh, reviewing the trawling question as it appeared at the time his scientific investigations were made for the Royal Commission of 1884, and as it appears now in the light afforded by further knowledge and research. In this preliminary communication, Professor M'Intosh deals with the question of immature and unsaleable fishes captured by the beam-trawl and by line fishermen, and shows that the conclusions on this subject, to which he was led in the investigations referred to, still remain good; and that line-fishing is quite as destructive as trawling to immature round fishes, such as cod and haddock. On the other hand, it appears that the takes of large cod and other adult forms within St Andrews Bay have rather increased, although it is difficult to say how far this is due to the closure and the absence of molestation, and how far to the fixed and extensive lines and special bait. The closure has also afforded a measure of protection to young turbot and brill. Comparatively few full-grown plaice are captured in the bay, but an enormous number of immature or half-grown plaice are reared there, and are captured by the liners, chiefly with lob-worms, their lines being buoyed and left in the water, relays of lines being often used. Very large hauls are sometimes obtained. The closure of the inshore waters, therefore, while it places the trawl-fishermen at a disadvantage, benefits the line-fishermen, and does not deprive the public altogether of the supply of flat fishes from the enclosed area. Large mature plaice, although rare in the bay, are captured in great numbers outside the three-mile limit, and thus the supply of ova and young fishes for the inshore waters is affected. Few or no spawning plaice are ever taken within the bay, though eggs and young in various stages are not uncommon. The same holds good to a large extent for many of the food-fishes.

In an interesting chapter, Professor M'Intosh describes in considerable detail the various changes which have occurred in the best types of steam-trawler of the present day compared with those of a decade ago. Among the more notable differences (besides the

greater size, strength, and speed of the vessels) are the greater use of ice for preserving the fish in special holds, and the increased coal capacity—both pointing to more distant voyages. The newest ships now carry two trawls, instead of one, as in 1884; but, while the ground-rope has been modified, no change has been made in the mesh of the trawl (1½ in.) at the 'cod'-end. In dealing with the present state of the beam-trawl fishery in relation to the fishing-grounds and the fishes, an elaborate comparison is made between the quantities and values of the various kinds of fishes landed by beam-trawlers and line-fishermen. It is shown that while the liners still catch more than three times the quantity of fishes which are captured by the trawlers, the latter are increasing their share and their stake in the fisheries year by year, and the line boats and men are diminishing in numbers. In 1884 trawling was carried on within a 'reasonable distance' of land, and at Aberdeen the chief supplies were obtained from the adjacent sea, or from the Moray Firth; but at the present day the main supply comes from the Great Fisher Bank—200 miles away—or from Iceland. Instead of the activity displayed in 1884 in the strip of sea from 10 to 20 miles off the coast between Aberdeen and Montrose, only a few vessels are now seen at work here and there in good weather and special seasons. Aberdeen trawlers also occasionally go to the west coast of Ireland, and to the Dogger Bank. The steam-liners and trawlers frequent the more distant grounds, not because the fishes are absent from the nearer grounds, but because their 'catches,' as a rule, far exceed in bulk those obtained on the latter. While, therefore, the present statistics show no serious diminution, it may be truly said that the total is kept up only by the supplies from Iceland, Faröe, and the Great Fisher Bank.

In treating of the effect of trawling on the invertebrates living on the bottom, which form a very large portion of the food of fishes, Professor M'Intosh points to the connection between the bottom-fauna and the pelagic life near the surface of the sea, to a large pelagic fauna having no relation to the bottom or to the locality, to the power which many invertebrates have of recuperation even when crushed and injured, and to many other considerations which serve to show that the damage done by the beam-trawl under this head must be comparatively small; and the same remark applies to the action of the hook of the liner. Respecting the effect of the trawl on the eggs of fishes, on certain ground-fishes, and very young fishes on the bottom, reasons are given to show that little injury is done in this way.

Scottish Mackerel Fishing.

Considerable attention has of late been given to the question of developing a profitable fishing for mackerel in Scottish waters, especially on the West Coast. The total quantity of mackerel landed in Scotland last year amounted to only 2900 cwts., valued at £2244, and nearly all of these were caught by accident in the herring nets, or, in small quantity, by hook. During recent years the mackerel fishing in several countries has undergone considerable expansion, notably in Norway and

Ireland, chiefly in consequence of the great and growing demand for the cured fish in the markets of the United States. To the Americans cured mackerel are what cured herrings are to the Teutonic peoples, and, from the continued failure of the American fishery, large quantities are now imported from Norway, Canada, Ireland, France, and elsewhere—amounting to over 70,000 barrels in 1893 at Boston, New York, and Philadelphia. In Ireland the mackerel trade has been developed to a very large extent by the efforts of the Fishery Inspectors and the Congested Districts Board, bounties having, in some cases, been given to the boats, and instructions in the art of curing furnished under the guidance of an expert from Norway. The industry thus fostered has been beneficial to the poorer classes of the population on the West Coast, by providing them with fairly remunerative employment.

There are good reasons for believing that a considerable and profitable trade in Scotch cured mackerel might be established with the United States, and that shoals of fine mackerel exist to the west of the Hebrides. In order to obtain information on this point, the Board, last year, entered into an arrangement with a native Barra crew to fish with mackerel-nets to the west and north-west of that island, and with a mackerel-curer of experience to cure the fish for the American market; and again, this year, during the continuance of the well-known herring fishing at Barra, one of the scientific staff, Mr Thomas Scott, F.L.S., and a fishery officer, Mr Duthie, were on the spot to collect all the information possible as to the mackerel captured in the herring-nets. The very early season, last year, and the stormy weather interfered with the experiments, so that only a few 'shots' of the mackerel-nets were made to the west of the island, and not far enough out; the largest number of mackerel caught, on any one occasion, was under 400. The Barra fish were found to be of superior quality and extra large in size, ranging from 14 to 18 inches, 228 to 236 of the cured fish going to the barrel. They would, therefore, fall into the first of the three classes into which mackerel are assorted for the American market; and it will be seen from the official reports from America, published along with other documents on the subject in Part I. of the present Report, that the Scotch mackerel sent to the United States have been the finest consigned from any part of Great Britain.

That mackerel are present in large numbers in spring and summer to the west and north-west of Barra is the general opinion of the local fishermen, and considerable quantities have been caught in the herring-nets. On one day in June, the 200 herring boats landed an average of one cran of mackerel each, and, in May, 70 crans were landed on two successive days. To test thoroughly whether mackerel are present in sufficient numbers to enable a profitable fishery to be started on the West Coast would probably require three or four properly equipped mackerel-boats fishing for several months. The expenditure would be considerable and beyond the power of the Board unless a special grant were obtained for the purpose.

Seine-Net Fishing for Herrings at Ballantrae Bank.

As stated in last year's report, complaints having been made by the fishermen of Ballantrae, Girvan, and other places on the coast of Ayrshire, that the use of the seine-net was injurious to the spring-herring fishery at Ballantrae Bank and off the Ayrshire coast, an inquiry was held on the subject at Girvan by Mr Esslemont, the Chairman, and Dr. Fulton; and arrangements made to investigate the action of the seine-net on the Bank, particularly in relation to its effect on the spawn of the herring, and in capturing large quantities of immature fish. The fishing season last year was interrupted by stormy weather, and few fish were caught, and the same thing happened this year, no seine-net being used on Ballantrae Bank, or in the neighbourhood. Although the necessary arrangements had been made, it was, therefore, not possible to proceed with the investigation. With reference to one of the principal allegations made against the use of seines in herring-fishing, namely, the destruction of large quantities of immature and unsaleable fish, an investigation is in progress on the Argyleshire coast. In connection with this subject it appears that during last year the number of men and boats employed in the various methods of fishing for herrings in the Clyde area, and the quantities and values of the herrings landed by them, were as follow :—

	Boats.	Men.	Crans.	£
Drift-net . . .	436	1279	53,348	45,440
Seine-net . . .	352	1474	63,854	57,449
Trammel-net . .	79	250	695	692

No unsaleable herrings were landed, and none sold for manure.

The Capture of Immature Fish by the Beam-trawl.

In previous Reports the determination of the size of immature fishes of various species, their distribution at various depths around the coast, their degree of vitality when captured, and various other points connected with the immature fish question have been dealt with. Last year an important Committee of Parliament was appointed, on the motion of the President of the Board of Trade, to enquire into this among other questions connected with sea-fisheries, and has recommended that the landing and sale of soles and plaice under eight inches, and of turbot and brill under ten inches, in extreme length, should be prohibited, the assumption being that such a measure would cause vessels, accustomed to trawl on certain grounds where small fish of these kind abound, to abstain from doing so. The question of the size of mesh of trawl-nets was raised, and the evidence given on this point was somewhat conflicting; the general opinion among the practical men being that the size of the mesh of the net had little or no influence on

the size of the fish captured, owing to the meshes being drawn together by the strain on the net while fishing. In order to ascertain the effect of variation in the size of the meshes of trawl-nets on the fish captured, a series of experimental trawlings were made by the 'Garland' during the course of the year, the results of which are given in a paper by Dr T. Wemyss Fulton in the present Report. Five different 'cod-ends' were used, the meshes varying from one-and-a-half to three inches, and a small meshed net was placed outside, enveloping the 'cod-end' so as to retain the fishes which passed through the meshes of the trawl. The number of hauls made was 67, and the fish captured numbered 57,714, of which 18,312, or about 31 per cent., were retained in the trawl-net, and 39,402, or about 69 per cent., escaped from it. The proportion which escaped rose greatly as the width of the meshes was increased, until, with a three-inch mesh, only about 6 per cent. of the fish which entered the trawl-net were retained by it, about 93 out of every hundred fishes escaping through the meshes. Tables are given, showing the details in each series of experiments and the numbers and sizes of the various species of round fishes and flat fishes captured.

The Life-Histories and Development of the Food and other Fishes.

To the present Report Professor M'Intosh contributes a valuable paper, giving the results of his continued investigations on the eggs, young, and development of a number of the food-fishes, the work having been carried on, as in previous years, at St Andrews Marine Laboratory. The eggs and young fishes, which have for the first time in this country been fully described and figured at St Andrews Marine Laboratory, include the cod, haddock, whiting, gurnard, ling, torsk, saithe, long rough dab, turbot, brill, plaice, lemon-dab, flounder, dab, sole, sail-fluke, sprat, frog-fish, halibut, sand-eel, &c.

In the present paper Professor M'Intosh gives a number of observations on the eggs of the green cod or saithe, fertilised eggs of this species having been obtained in Gairloch, Ross-shire, and transported to St Andrews. The saithe closely resembles the cod in its development, but the arrangement of the pigment distinguishes it from a very early stage, though, in the later stages of larval life, the one approaches the other. It is probable that in former years the ova of this species, as well as the larvæ, occurred in various collections, but until now it has been difficult to predicate with certainty. Further researches on the eggs and larvæ of the turbot are described; it is pointed out that the larvæ are very buoyant, keeping near the surface of the water. An unknown egg, resembling that of the sail-fluke, is described, and an account given of *Lumpenus lampetræformis*, and of the Norwegian topknot.

A description is furnished by Mr H. C. Williamson, M.A., B.Sc., and Mr Tosh, M.A., B.Sc., of the various pelagic eggs, larvæ, and young fishes obtained by the tow-nets of the 'Garland,' and of the

boat 'Dalhousie' in the Firth of Forth and St Andrews Bay, and other parts of the East Coast. About the middle of May immense swarms of young flat-fishes and sand-eels were obtained off Aberdeen, Montrose, and Stonehaven, as many as 20,000 of these young forms being captured in a single haul of the tow-nets.

The Pelagic Fauna and the Rate of Growth of the Food-Fishes.

In the present Report will be found several papers dealing with the nature and distribution of the pelagic fauna and food of fishes. The enquiries on this subject, carried on by Mr Thomas Scott, F.L.S., particularly in the area of the Firth of Forth, have resulted in extensive additions to our knowledge of the pelagic fauna. In his sixth contribution in the fauna of the Firth of Forth, Mr Scott has been able to add forty-three species of Copepoda, one species of Ostracoda, ten species of Amphipoda, one species of Annelida, and one of Mollusca, to the previous faunistic lists—or fifty-six species of invertebrates in all. Seventeen species of Copepoda are described for the first time; and the total number of species of Crustacea, found in the Firth of Forth, has been brought up to over 480, which shows the richness of the area as a feeding-ground for young fishes.

In another paper Mr Scott gives the results of an investigation made into the pelagic fauna of a number of important fishing lochs,—Loch Tay, in Perthshire, Loch Mullach Corrie, Loch Awe, and Loch Assynt, in Sutherlandshire. The tow-net collections, from the three Sutherlandshire lochs, were made and preserved by Mr W. S. Caine, M.P., during a sojourn in the district. Mr Caine also kindly forwarded samples of aquatic plants, and trout, and trouts' stomachs from the lochs referred to, so that an investigation might be made of the food-material.

The rate of growth of the food-fishes has, during the past few years, received considerable attention. In the present Report will be found a paper by Dr J. H. Fullarton, on the oviposition and rate of growth of the sand-eel. The spawning and habits of the sand-eel are reviewed; the fertilisation of the eggs described; and the measurements of a large number of young forms given.

In another paper Mr J. R. Tosh, M.A., B.Sc., gives the results of his observations, at St Andrews Marine Laboratory, on the rate of growth of the lumpsucker, the sea-scorpion, the pogge, and the diminutive sucker. A considerable number of specimens of these species, of various sizes and ages, were examined and measured, the details being set forth in a series of tables.

The anatomy of the pectoral arch of the gurnard (*Trigla gurnardus*), with special reference to the innervation of the remarkable free rays or "feelers," is very fully described by Mr H. C. Williamson, M.A., B.Sc., the research having been carried on at the Marine Laboratory, St Andrews. Mr Williamson's paper is illustrated by a series of elaborate drawings.

In the present Report will also be found a careful detailed description by Mr Arthur T. Masterman, B.A., of the skeleton of

the Tunny, from a specimen captured in the Firth of Forth, and a paper by Mr George Sandeman, M.A., F.Z.S., on a number of interesting researches on the physiology and pathology of fishes.

Physical Observations.

As previously stated, the Board took part in an international hydrographic survey of the northern portion of the North Sea, in conjunction with the authorities in Germany, Sweden, Norway, and Denmark. The Continental investigators concerned themselves principally with the physical variations of those portions lying in relation to the Skagerrak and Baltic. On this side the work consisted in an examination of the channels connecting the North Sea with the North Ocean and with the Atlantic, including the Faröe-Shetland Channel, in order to ascertain the sources of the different waters flowing through them, and the manner of their passage at different times of the year. The observations were conducted by Mr H. N. Dickson, F.R.G.S., F.R.S.E., assisted by Mr Thomas Mortimore, on board H.M. 'Jackal,' in August and November 1893, and February and May of the present year, concurrent observations being made by the Continental observers at appointed stations on the same days. When the simultaneous observations of the other vessels engaged in the survey are published, the combined data will, it is believed, afford synoptic charts of the whole of the North Sea and the surrounding areas at four terminal dates during the year. One important conclusion, which will be found fully described in Mr Dickson's report, in relation to the currents in the North Sea, is indicated by the movement of a mass of Atlantic water which, by the preceding hydrographic conditions, is gradually admitted round the north end of the Shetlands, passes down the east side of the groups, joins the tidal stream at the south end, and is distributed along the East Coast of Scotland during July and August. It is probable that the movement of this mass of Atlantic water along our eastern seaboard will be found to have close relations with the great summer herring fishing in these months, the progress of which is in the same direction, inasmuch as Professor Pettersson, the Swedish investigator, has already shown a similar connection between the physical conditions in the Baltic and the mackerel- and herring-fisheries of that region.

Contemporary Fishery Work.

An account as given in Section D, by Dr T. Wemyss Fulton, of the progress of contemporary fishery work and investigations in nearly all the European maritime States, and in America.

The Board is indebted to a large number of foreign fishery authorities and others for co-operation in connection with their scientific work. Among these may be mentioned: Dr P. P. C.

Hoek, the Scientific Superintendent of Dutch Fisheries; Professor Pouchet, the Director of the Concarneau Laboratory; Professor Marion, the Director of the Marine Laboratory at Marseilles; M. Raveret-Wattel, Secretary to the Société Nationale d'Acclimatation de France; Drs Sauvage and Canu, of the Marine Station, Boulogne-sur-mer; Captain Dannevig, the Superintendent of the Sea-Fish Hatchery at Flödevig, Norway; Captain Drechsel, Superintendent of Danish Fisheries, and the Naturalist, Dr C. G. J. Petersen; Señor Rafael Gutierren Vela, of the Spanish Fisheries Department; Professor Giglioli, Fishery Commissioner, Florence; Dr A. M. Malm and Dr Rudolf Lundberg, the Inspectors of Swedish Fisheries; Sir C. H. Tupper, K.C.M.G., the Minister of Marine and Fisheries, Canada, and Professor E. E. Prince, F.L.S., the Canadian Commissioner of Fisheries; Mr Adolf Nielsen, the Superintendent of the Newfoundland Fisheries, and the Rev. Mr Harvey, the Chairman of the Fishery Commission; Kloster-Kammer-director Herwig, the President of the Deutscher Fischerei Verein; Dr Heincke, the Director of the Biological Institute, Heligoland; Dr Ehrenbaum of Carolininsiel; The Prince of Monaco; Baron Jules de Guerne; and Mr Lindsay Thompson, the Chief Inspector of Fisheries, New South Wales.

We have the honour to be,

Sir,

Your most obedient Servants,

P. ESSLEMONT, *Chairman.*
JOHN GUTHRIE SMITH, *Deputy-Chairman.*
GEORGE H. M. THOMS.
D. M'KECHNIE.
W. C. M'INTOSH.
WILLIAM BOYD.

The following Members dissenting:—

JAMES JOHNSTON.
J. RITCHIE WELCH.
W. ANDERSON SMITH.

SECTION A.—GENERAL REPORTS.

I.—REPORT ON THE TRAWLING EXPERIMENTS OF THE 'GARLAND,' AND ON THE STATISTICS OF THE EAST COAST FISHERIES RELATING THERETO. Part VIII.

INTRODUCTORY.

During last year the trawling experiments of the 'Garland' were carried on at the various stations on the East Coast of Scotland, as in former years. The stations in the Firth of Forth and St Andrews Bay were examined once a month, so far as circumstances permitted, and those in the Moray Firth and off the Coasts of Forfarshire and Aberdeenshire on two occasions. The number of ordinary trawlings or periodic examinations of the stations in the course of the year was 181, of which 96 were in the Firth of Forth area, 37 in the Moray Firth, and 30 in St Andrews Bay. The stations in the Firth of Clyde and at the Orkney Islands, where the waters were closed by the Herring Fishery (Scotland) Act of 1889, were not examined during the year from want of means. The detailed results of the trawling observations will be found in the various tables annexed to this Report.

In addition to the systematic inquiry into the influence of beam-trawling on the abundance of the fish supply, the 'Garland' carried on throughout the year a series of observations on other important fishery questions. Special visits were made, when the weather was sufficiently favourable, to some of the fishing-grounds lying off the shore, and the investigations concerning the spawning and spawning-grounds of the food fishes, the nature and distribution of fish-food, the relative abundance and distribution of pelagic fish eggs and young fishes, &c., were continued. The study and description of the collections of pelagic eggs and larval and post-larval fishes have, as in previous years, been under the supervision of Professor M'Intosh, F.R.S., and some of the results are given in the present Report. In connection with the sea fish hatchery at Dunbar the 'Garland' was also employed in procuring adult flat-fishes and in transporting the fry to the fishing grounds.

Continuous physical observations on the temperature, salinity, and transparency of the sea have also been made at the various trawling stations and along selected lines in the Firth of Forth.

Owing to the closure of the whole of the Moray Firth within a line from Rattray Point to Duncansbay Head to beam-trawling, which came into force on the 22nd November 1892, the 'Garland' has been engaged there in the trawling investigations to a greater extent than previously, and as far as circumstances would allow. The special stations selected

with the view of testing the influence of the closure on the abundance of the fishes within its waters are described below. Arrangements have also been completed by which special statistics will be collected as to the quantities of the various kinds of fish caught within the closed waters by line fishermen.

From the great area of the Moray Firth and the fact that it contains extensive spawning-grounds of white fish, the most important of which is the well-known Smith Bank, the experiment of closing it to beam-trawling will be watched with much interest.

The statistics collected in connection with the trawling experiments, showing the relative amounts of fish landed by line fishermen and beam-trawlers along the East Coast, the quantities obtained by line fishermen from the territorial waters, where trawling is prohibited, &c., are discussed below. A part of the work connected with the tabulation of some of these statistics has fallen upon the fishery officers of the districts concerned, namely, Mr John Murray, Newhaven; Mr Mair, Anstruther; Mr Duff, Montrose; Mr Bain, Stonehaven; and Mr Couper, Aberdeen. The trawling returns were almost all kept by Mr Thomas Scott, F.L.S. I have also to acknowledge the assistance of Mr J. G. Anderson in the tabulation of the statistics, and the care and zeal with which Captain R. Campbell, in command of the 'Garland,' has discharged his duties.

II. THE WORK OF THE 'GARLAND.'

1. The Firth of Forth.

The various trawling stations in the Firth of Forth area were examined last year once each month, with the exception of March. The total number of ordinary trawlings at these stations was 96, of which 77 were made at the stations within the closed waters and 19 at the two stations outside. The tables giving these observations will be found at p. 45, and the analyses of the figures at p. 42. Dealing, first of all, with the stations in the closed area (I.–VII.), it will be found that a considerable increase occurred in the total abundance of fish as compared with 1892. In the latter year the average per 'shot,' or haul of the net, for all kinds of fish, was 184·4, while last year the average was 287·6. In 1891 the corresponding average was 189·4. This increase was due principally to an increase in round-fish, which in 1892 yielded an average per 'shot' of 71·3, as compared with 162·4 last year. There was also an increase in the abundance of flat-fishes, namely, from an average number per 'shot' of 106·3 in 1892 to an average of 120·5 in 1893. At the stations outside the limits of the closed waters (VIII. and IX.), where beam-trawling is actively carried on, there was a large increase of round-fishes and a less considerable increase in flat-fishes. The average catch of round-fishes in 1892 was 73·0, while last year it was 208·8. In the former year the average for flat-fishes was 43·0, as compared with 55·4 in 1893. The results of the trawling experiments in the Firth of Forth area last year therefore show a considerable increase of round-fishes and a smaller increase in flat-fishes both in the closed waters and in the open waters—but relatively greater in the latter than in the former.

The figures representing the mean average catch of flat-fishes and round-fishes per 'shot' of the trawl at the seven stations within the closed

area, and at the two stations in the open area, in each year since these experiments were begun, are given in the following tables :—

CLOSED AREA.

Year.	No. of Hauls.	Average Catch per Haul.		
		Flat Fish.	Round Fish.	All Fish.
1886	22	115·2	131·7	251·1
1887	28	200·6	144·4	351·5
1888	40	114·6	92·1	211·4
1889	70	109·1	49·8	164·8
1890	63	100·9	121·9	228·9
1891	84	115·0	67·7	189·4
1892	77	106·3	71·3	184·4
1893	77	120·5	162·4	287·6

OPEN AREA.

Year.	No. of Hauls.	Average Catch per Haul.		
		Flat Fish.	Round Fish.	All Fish.
1886	5	44·0	36·4	85·4
1887	6	88·7	123·4	213·7
1888	10	32·6	114·7	151·2
1889	20	38·3	68·6	111·9
1890	16	53·7	184·7	241·6
1891	24	50·8	38·6	93·0
1892	22	43·0	73·0	119·4
1893	19	55·4	208·8	267·6

Considering the relative abundance of the various kinds of fish within the closed area, the tables show that among flat-fish there was an increase of all kinds, except long rough dabs, turbot, and brill. The greatest increase was in common dabs, the average in 1892 being 36·0, and last year 44·1. Among round-fish there was a decrease in whitings and an increase in cod, haddocks, and gurnards. The increased abundance of haddocks was remarkable, the averages for 1892 and 1893 being respectively 22·1 and 118·8. At the stations in the open area the increase in the flat-fishes was common to all kinds. Among round-fishes there was a slight decrease in whitings and a very large increase in haddocks, the average for the latter rising from 42·4 to 176·3. Most of the haddocks taken were small and immature; the unusual prevalence of small haddocks was a feature of the fishing along the whole East Coast.

2. St Andrews Bay.

During 1893 30 hauls of the trawl were made at the stations in St Andrews Bay—24 at those within the closed area, and 6 outside. In

the closed waters there was a slight increase in the general average of fish captured per 'shot'—from 128·4 in 1892 to 148·2 in 1893. The increase was chiefly in flat-fishes, the average catch of which was 102·8 last year compared with 84·0 in the previous year. There was a less considerable increase in the average for round-fish, namely, 43·9 as against 36·6 in 1892. At the station in the open area the results show a falling off in the abundance of fish, the average per haul in 1892 being 105·7, while last year it was 93·3. This decrease took place entirely in flat-fish, the average catch of which last year was 30·5, as against 50·3 in the previous year. Round-fishes, on the other hand, increased from an average per 'shot' of 53·6 in 1892 to 61·5 lasf year. The averages for each year since the trawling experiments were initiated are given in the following table:—

CLOSED AREA.

Year.	No. of Hauls.	Average Catch per Haul.		
		Flat Fish.	Round Fish.	All Fish.
1886	15	147·0	27·6	176·8
1887	16	340·7	87·5	428·8
1888	20	213·2	68·9	286·0
1889	28	187·4	19·2	209·5
1890	24	302·9	40·0	347·2
1891	27	109·4	19·8	133·8
1892	32	84·0	36·6	128·4
1893	24	102·8	43·9	148·2

OPEN AREA.

Year.	No. of Hauls.	Average Catch per Haul.		
		Flat Fish.	Round Fish.	All Fish.
1886	3	97·2	72·8	171·6
1887	4	129·4	173·3	308·4
1888	5	148·3	72·4	221·2
1889	7	151·4	29·8	183·1
1890	6	29·8	35·6	66·8
1891	6	261·8	30·8	300·1
1892	8	50·3	53·6	105·7
1893	6	30·5	61·5	93·3

With regard to the increase or decrease of the various kinds of fish within the closed waters, the tables show that there was a large increase in plaice and a decrease of flounders, turbot, and brill. Among round-fish there was an increased catch of cod, and especially of haddocks; gurnards and whitings decreased in abundance. At the station in the open area there was a decrease of plaice, common dabs, gurnards, and whitings, and an increase in cod and haddocks.

3. The Moray Firth.

The whole of the Moray Firth, within a line extending from Duncansbay Head to Rattray Point, comprising over 2000 square miles in area was closed to beam-trawling by a bye-law, in accordance with the provisions of the Herring Fisheries (Scotland) Act, 1889, which came into force on 22nd November 1892. In addition to the six trawling stations in the territorial waters of the Firth selected in 1887 and described in the Sixth Annual Report (p. 31), ten other stations were selected in the off-shore waters. Their position and limits are as follows:—

Station VII. begins $3\frac{3}{4}$ miles off Tarbet Ness, and runs nearly E. by S. $\frac{1}{2}$ S. for $3\frac{1}{2}$ miles. The bottom consists of sand and mud, and the depth varies from 22 to 28 fathoms.

Station VIII. lies 12 miles off Tarbet Ness in an E.S.E. direction. It begins 9 miles N. $\frac{3}{4}$ E. of Lossiemouth, and runs N. by W. for $3\frac{1}{2}$ miles. The bottom is sand and mud, and the depth 28 to 31 fathoms.

Station IX. is parallel with VIII., and 4 miles further east. It is 3 miles in length. The bottom consists of sand and mud, and the depth varies from 28 to 32 fathoms.

Station X. lies $3\frac{1}{2}$ miles from Lossiemouth, running $3\frac{1}{2}$ miles from N.W. to S.E. nearly. The depth ranges from 15 to 13 fathoms, and the bottom is composed of sand and shells.

Station XI. lies across Smith Bank. It runs for 5 miles E. by N. from a point $16\frac{1}{2}$ miles E.S.E. $\frac{1}{4}$ S. of the Ord of Caithness. The bottom is sand and shells, and the depth between 18 and 25 fathoms.

Station XII. is also on Smith Bank, at right angles to Station XI. It begins at a point $10\frac{1}{2}$ miles S.E. by S. of Clyth Ness, and extends S. by E. for 5 miles. The depth is from 18 to 21 fathoms, and the bottom sand and shells.

Station XIII. is parallel with Station XII., and lies outside Smith Bank. It begins $13\frac{1}{2}$ miles S.E. by E. $\frac{1}{4}$ E. of Clyth Ness, and runs for 6 miles S. by E. The bottom consists of sand and sand and shells, and the depth ranges from 22 to 27 fathoms.

Station XIV. begins 3 miles E. by S. $\frac{1}{2}$ S. of Clyth Ness, and extends for 5 miles in a S. by E. direction. The depth is about 30 fathoms, and the bottom sand and shells.

Station XV. begins at a point $10\frac{1}{2}$ miles S.E. by E. of the Ord of Caithness, and runs for 6 miles S. by E. The bottom is composed of sand and mud, and the depth varies from 23 to 31 fathoms.

Station XVI. begins $18\frac{1}{2}$ miles N. of Macduff, and runs for 6 miles in a northerly direction. The depth ranges from 34 to 36 fathoms, and the bottom is sandy.

During the year the stations in the Moray Firth were examined in May and October, 37 hauls of the trawl being made. The catches in the latter month were very much larger than those in May, the increase being chiefly in flat-fish; but no conclusion can be drawn from an isolated observation. The average of 21 shots at the various stations in May was 60·8 flat-fish. The average of 16 shots in October was 258·3 flat-fish. The average number of plaice in each shot of the trawl rose from 6·7 in May to 89·4 in October; the averages of other flat-fish being as follows in the two months:—Lemon soles, 3·3 and 8·6; common dabs, 39·1 and 145·1; long rough dabs, 11·2 and 13·1. There was also an increase, but not so striking, in round fishes, viz., from 86·7 in May to 131·9 in October. The averages of the various kinds in the two months were as follows:—Cod, 4·4 and 3·8; haddocks, 51·7 and 95·3; whitings, 10·2 and 4·0; gurnards, 20·3 and 28·9.

The cessation of beam-trawling in so large an area will to some extent account for the increase in flat-fishes, since it is by this mode of fishing that they are chiefly obtained for the market; but it is too soon yet to draw any conclusions as to the results of the closure. An increase of a similar kind followed the prohibition of trawling in the Firth of Forth and St Andrews Bay; but, as may be seen from other parts of this report, the increase was not maintained. The Moray Firth differs from the areas mentioned in one important respect, inasmuch as it contains within it extensive spawning grounds for white fishes, the best known of which is the famous Smith Bank.

4. The Firth of Clyde.

In the Firth of Clyde, which was closed in 1889 to beam trawling within a line from the Mull of Cantyre, Argyleshire, to Corsewall Point in Wigtownshire, comprising over 600 square miles, twelve stations for carrying on experiments as to the influence of the closure of the water were selected in 1887. These stations have been examined on two occasions, once in 1887 and once in 1890, but have not been examined since the latter year. There is not, therefore, any information available as to the results of the prohibition of beam trawling on the fishing grounds in the area of the Firth of Clyde.

III.—SPECIAL STATISTICS OF FISH CAUGHT BY LINE FISHERMEN AND BEAM-TRAWLERS.

1. Relative Quantities of Fish taken by Line and Beam-Trawl.

In considering the influence of beam-trawling on the fish supply, it is necessary to bring into comparison with the results of the trawling experiments certain facts relating to the quantities of flat-fish and round-fish captured by line and trawl in the districts where the trawling experiments are carried on. On the East Coast, between Aberdeen and Dunbar, the total quantity of flat-fish and round-fish landed by beam-trawlers and line fishermen in 1893 was 759,062 cwts., as compared with 804,451 cwts. in 1892 and 759,440 cwts. in 1891. Of this amount line fishermen landed 381,021 cwts. and beam-trawlers 376,041 cwts.; while in 1892 the former landed 432,234 cwts. and the trawlers 372,216 cwts. The decrease was, therefore, entirely in the fish landed by line fishermen. The quantity of flat-fish landed was 87,719 cwts.—a decrease of 18,451 cwts. as compared with 1892. Of this total, 21,004 cwts. were caught by line and 66,715 cwts. by trawl. In the previous year line fishermen landed 35,114 cwts., and trawlers 71,055 cwts. It will be observed that there was a decrease in 1893 in the quantity of flat-fish caught both by line fishermen and beam-trawlers. The quantity of round-fish landed also shows a considerable decrease. In 1892 the total was 698,281 cwts., while in 1893 it was only 669,343 cwts. This falling off is entirely accounted for by the lesser quantity landed by line fishermen, which was 37,103 cwts. below the amount for the previous year. On the other hand, there was a slight increase in the quantity captured by the beam-trawl, the total for the two years being respectively 301,161 cwts. and 309,326 cwts., or an increase of 8,165 cwts.

The gross quantities of white-fish landed by the two modes of fishing in

the districts referred to during the last four years are given in the following table :—

Year.	Line Boats.			Beam-Trawlers.		
	Flat Fish.	Round Fish.	Total.	Flat Fish.	Round Fish.	Total.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
1889	23,035	453,554	476,589	60,117	155,601	215,718
1890	28,170	430,057	458,227	72,219	208,625	280,844
1891	25,587	418,281	443,868	76,347	239,224	315,571
1892	35,114	397,120	432,234	71,055	301,161	372,216
1893	21,004	360,017	381,021	66,715	309,326	376,041

This table shows that during the period mentioned there has been at this part of the coast a gradual falling off in the quantities of line-caught fish and a considerable increase in the quantities caught by the beam-trawl. Thus, as compared with 1889, there has been a decrease of white-fish landed by line fishermen to the extent of 95,568 cwts., and an increase of 160,323 cwts. in the quantities landed by beam-trawlers.

The most important figures in relation to the trawling experiments are those dealing with flat-fish. It will be seen that while the quantity of round-fish caught by beam-trawlers has very greatly increased, from 155,601 cwts. in 1889 to 309,326 cwts. in 1893, or an increase of 98·8 per cent., the quantity of flat-fish in the same period has increased by only 6,588 cwts., or 10·9 per cent. The quantity of flat-fish landed by trawlers last year is less than in the three previous years, although the quantity of round-fish is greater. Thus, while trawl-caught round-fish increased in 1893 compared with 1892 by 8,165 cwts., or 2·6 per cent., the flat-fish caught by trawl diminished by 4,340 cwts., or 6·1 per cent. The figures referring to the quantities of the different kinds of fish landed show how these results have been produced. Among flat-fishes, trawlers in the districts referred to landed in 1893 3,486½ cwts. of turbot, 554½ cwts. of halibut, 16,976 cwts. of lemon soles, and 45,698 cwts. of 'flounders, 'plaice, and brill.' In 1892, the respective quantities were :—Turbot 3,577½ cwts., halibut 128 cwts., lemon soles 23,102 cwts., and 'flounders, 'plaice, and brill' 39,468 cwts. These figures show a decrease in all kinds of flat-fish; that in lemon soles is noteworthy.

The line fishermen landed 152 cwts. of turbot, 10,882 cwts. of halibut, 99 cwts. of lemon soles, and 9,871 cwts. of 'flounders, plaice, and brill.' In the previous year the quantities were :—Turbot 142¼ cwts., halibut 12,856 cwts., lemon soles 52½ cwts., and 'flounders, plaice, and brill' 8,833 cwts.

Of round-fishes, beam-trawlers landed in 1893 52,896 cwts. of cod, 4,606 cwts. of ling, 3,054 cwts. of saithe, 241,361 cwts. of haddocks, 7,365 cwts. of whitings, and 44 cwts. of conger eels. In the previous year the quantities were as follows :—Cod 39,299 cwts., ling 2,571 cwts., saithe 1,655 cwts., haddocks 208,460 cwts., whitings 7,232 cwts., conger eels 77 cwts.

The quantities of the various kinds of round-fishes landed in 1893 by line fishermen in the districts under consideration were as follows :—Cod 141,552 cwts., ling 22,245 cwts., tusk 898 cwts., saithe 13,465 cwts., haddocks 168,448 cwts., whitings 12,593 cwts., and conger-eels 816 cwts.

In the previous year the respective quantities were :—Cod 133,858 cwts., ling 17,413 cwts., tusk 405 cwts., saithe 14,402 cwts., haddocks 180,589 cwts., whitings 15,764 cwts., conger-eels 620 cwts.

The total quantities of flat-fish and round-fish landed by line fishermen and beam-trawlers along the whole of the East Coast of Scotland, including the five districts specially referred to above, are given in Table D. It shows, as in previous years, that the gross quantity of white-fish landed by beam-trawlers has increased, while the quantity taken by line has diminished. The totals for the past six years are as follows :—

Year.	Round Fish.		Flat Fish.	
	Line.	Beam-Trawl.	Line.	Beam-Trawl.
	cwts.	cwts.	cwts.	cwts.
1888	1,029,961	179,074	60,752¼	64,723¾
1889	1,057,450	166,818	53,870¾	60,595¾
1890	993,180½	212,475½	58,673	73,141
1891	957,609	227,894½	52,302¼	76,006
1892	859,352½	303,424	64,874½	72,960½
1893	738,155½	343,884	36,903	72,157½

2. Statistics Showing the Quantities of Line-Caught Fish obtained from Territorial Waters.

Special statistics are given in Table G. (p. 162) showing the quantities of fish caught by liners in the territorial waters of the East Coast, from North Berwick in the south to Skateraw, a few miles south of Aberdeen. The monthly and yearly averages per 'shot' for each kind of fish captured are also given; and Table H. (p. 164) indicates the quantities and averages for each district for the last three years.

An examination of the various tables shows that during 1893 there was a slight increase in the number of 'shots' in the portion of the territorial waters under consideration, namely, 34,631 as against 32,543 in the previous year. There was, however, a decline in the quantity of fish caught, both absolutely and in proportion to the number of shots, the average per 'shot' for the year being 1·703 cwts. as compared with 1·94 cwts. in 1892. The quantity of fish taken, and also the average catch per 'shot,' were less last year than in any year since the statistics have been obtained. The figures for the various years are as follows :—

Year.	Total Trips or Shots.	Quantity of White Fish caught.	Average Quantity per Shot.
		cwts.	cwts.
1888	43,077	109,396¼	2·539
1889	42,898	107,029¼	2·494
1890	34,501	83,692¼	2·425
1891	37,928	92,469	2·438
1892	32,543	63,420¼	1·94
1893	34,631	59,949	1·703

The falling off in the quantity of fish taken in the territorial waters was common to all kinds except flat-fish, which increased very little; the decrease in cod and whitings was specially noticeable.

In each of the four districts from which these special statistics are obtained, cod were caught in diminished numbers, except in the Montrose District, where a slight increase was indicated. The quantity of haddocks and whitings was also less in three of the four districts. On the other hand, the group of flat-fishes included under the heading 'lemon soles, flounders, 'and dabs,' and which to a large extent comprises plaice, showed a slight increase in two of the districts, and remained stationary at the other two. In the following table, which has been furnished by Mr Mair, the Fishery Officer of the Anstruther District, the quantities of haddocks and whitings captured by line fishermen within the closed and open waters, and landed in his district in each of the last six years, are given :—

Year.	Caught within the Closed Area.		Caught outside the Closed Area.		Total.	
	Haddocks.	Whitings.	Haddocks.	Whitings.	Haddocks.	Whitings.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
1888	18,419	1,800	17,862	1,131	36,281	2,931
1889	12,499	1,972	19,405	1,645	31,904	3,617
1890	12,418	1,994	10,338	1,595	22,756	3,589
1891	11,981	1,577	11,255	1,244	23,236	2,821
1892	11,718	936	16,647	862	28,365	1,798
1893	12,318	767	9,719	318	22,037	1,085

3. Buckhaven Haddock and Cod Line Fishing.

The statistics of the cod and haddock line fishing of Buckhaven, specially collected by Mr Mair, the Fishery Officer of the district, since 1884, are given in Table D. for 1892 and 1893. The number of 'shots' or visits to the fishing grounds in 1893 was slightly less than in the previous year, showing that the falling off, which began in 1887, still continues. The number of 'shots' was 3,101 as against 3,112 in 1892, and 7,869 in 1886.

Although the number of 'shots' was a little less than in the previous year, the quantity of cod captured was greater, giving an average of 1·00 per shot, as compared with 0·44 in the previous year and 0·91 in 1891. Small haddocks also were caught in much greater numbers, the average number per shot being 289·4, as against 76·9 in 1892 and 92·8 in 1891. On the other hand, large haddocks decreased in abundance, the average being 42·7, as compared with 50·1 in 1892 and 103·8 in 1891. The figures for the last ten years are as follows :—

Year.	Total Number of 'Shots' during the Year.	Average Number of Cod per 'Shot.'	Average Number of Large Haddocks per 'Shot.'	Average Number of Small Haddocks and Whitings per 'Shot.'
1884	4524	0·34	22·1	38·3
1885	4542	0·50	23·4	221·5
1886	7869	0·32	31·8	147·0
1887	6270	0·23	42·8	208·9
1888	5548	0·45	62·6	228·4
1889	4535	0·46	80·1	68·4
1890	3396	0·72	78·8	130·5
1891	3296	0·91	103·8	92·8
1892	3112	0·44	50·1	76·9
1893	3101	1·00	42·7	289·4

As in previous years, the largest proportions of cod were taken in December and January, and of small haddocks and whitings during the summer months.

Summary.

The results of the trawling experiments in the Firth of Forth and St Andrews Bay areas in 1893 indicate a considerable increase in flat-fishes and a great increase in round-fishes within the waters from which beam-trawling is prohibited, and a similar although less noteworthy increase in the open waters outside. The special feature was the unusual abundance of round-fishes. In 1892, the average number of these captured in each haul of the net in the closed waters of the Firth of Forth was 71·3, while last year it was 162·4, the greatest number since the trawling experiments were begun. In the open waters of the Forth area the average number caught was 208·8, compared with 73·0 in 1892, —and here again the average is greater than hitherto recorded. In the closed waters of St Andrews Bay the increase was not so marked; nevertheless, the average number of round-fishes captured in each haul is greater than in any year since 1888. The same remark applies to the open waters.

On examination of the figures relating to the different kinds of round-fishes, it becomes apparent that this increase is almost entirely accounted for by the extraordinary abundance of small haddocks, especially in the region of the mouth of the Firth of Forth, during last summer and autumn. In one case (in August) 1333 were taken in a single haul of the net. Thus, the average number of haddocks captured per 'shot' in the closed waters rose from 22·1 in 1892 to 118·8 last year; and in the open waters the average was also increased from 42·4 to 176·3. In St Andrews Bay also, where the average number of haddocks caught in 1892 was only 1·0, the average last year was 23·8. The average in the open area likewise increased from 8·8 to 43·8. Thus the increase in round-fishes was in reality almost entirely an increase in haddocks; although cod also increased, but to a much less extent.

Turning to flat-fishes, we find that they also were caught in greater numbers in 1893 than in the year before, both in the closed and open waters, and in the Firth of Forth as well as in St Andrews Bay. The increase is not, however, comparable to that in round-fishes; nor does it indicate anything like the abundance of these fishes which marked the years following the closure of the waters. The average last year, both in the closed and in the open areas, ranks above the average of two of the preceding seven years and below that of five of them. In the Firth of Forth it was 120·5, compared with 106·3 in 1892; in St Andrews Bay it was 102·8, against 84·0 in the previous year.

The statistics of the 'Garland's' trawling experiments during the last eight years in the combined areas of the Firth of Forth and St Andrews Bay are as follows, the figures indicating the average number of fishes obtained in each haul of the net in each of the years mentioned:—

Year.	Closed Area.			Open Area.		
	Flat Fish.	Round Fish.	Total.	Flat Fish.	Round Fish.	Total.
1886	131·1	79·6	213·9	70·6	54·6	128·5
1887	270·6	115·9	390·1	109·0	148·3	261·0
1888	163·9	80·5	248·7	90·4	93·5	186·2
1889	148·2	34·5	187·1	94·8	49·2	147·5
1890	201·9	80·9	288·0	41·7	110·1	154·2
1891	112·2	43·7	161·6	156·3	34·7	196·5
1892	95·1	53·9	156·4	46·6	63·3	112·5
1893	129·0	149·0	282·4	49·4	173·5	225·8

It will be noticed that in the case of round-fishes the average for last year is greater than that of any of the preceding years, both in the closed and in the open waters. In order that comparison may be made between the results obtained in the few years following the prohibition of trawling and those obtained in the last few years, the numbers of fishes captured have been reduced to averages for the two periods, each comprising four years. They are as follows:—

Years.	Closed Area.			Open Area.		
	Flat Fish.	Round Fish.	Total.	Flat Fish.	Round Fish.	Total.
1886–1889	178·5	77·8	260·0	91·2	86·4	180·8
1890–1893	134·6	81·9	222·1	73·5	95·4	172·3

These figures show that the average number of round-fishes captured during the last four years exceeds the average number taken during the first four years; a result due to the unusual numbers of small haddocks which characterised the fishing of 1893. On the other hand, notwithstanding the increase last year in the quantity of flat-fish taken, the average

for this group is considerably less for the latter of the two periods than for the first. These results contrast in a striking manner with those indicated in last year's report.

In regard to the closure of the Moray Firth to beam-trawling, there is as yet no information to show whether this procedure has been beneficial, or to what extent it is likely to be followed by an increased abundance of the food fishes in the closed waters. Sixteen trawling stations within the limits of the Firth were examined twice last year. The number of the food fishes, especially of flat-fishes, captured on the second occasion was considerably greater than in the first series of trawlings; but the examination took place at different seasons, and no deduction can be made from this. From the very large area closed to beam-trawling—comprising over 2,000 square miles of the sea bottom—and the presence within it of extensive spawning grounds, it would be of the greatest value if a systematic examination of the fishing grounds could be made at brief intervals, a duty for which the 'Garland' is, however, but ill-fitted. Special statistics are being collected along the coasts of the firth, in order to determine from year to year the quantities of round-fishes and flat-fishes captured within it by line fishermen.

T. WEMYSS FULTON,
Superintendent of Scientific Investigations.

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1893.

Station and Date.	Flat-Fish.									Round-Fish.							
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.	Skate.	Other Fish.	Total.
FIRTH OF FORTH—																	
Station I.																	
Jan. 17,	.	8	.	2	43	.	.	.	53	64	.	23	.	87	7	3	150
Feb. 21,	4	12	.	5	17	.	.	.	38	28	.	4	.	32	5	8	83
April 20,	14	36	.	48	14	3	.	.	115	13	9	4	16	42	2	5	164
May 27,	19	20	.	29	13	.	.	.	81	6	6	3	42	57	1	15	154
June 15,	20	31	.	9	6	.	.	.	66	19	43	2	19	88	2	4	160
July 31,	55	54	.	45	32	.	1	.	187	34	141	52	21	248	.	6	441
Aug. 24,	67	68	.	68	36	.	.	.	239	30	67	70	41	208	1	4	452
Sept. 20,	49	62	.	40	12	.	.	.	163	5	2	.	16	23	.	5	191
Oct. 25,	38	26	.	18	15	.	.	.	97	21	51	19	6	97	3	1	198
Nov. 15,	4	14	.	39	21	.	.	.	78	17	14	2	1	34	6	7	125
Dec. 20,	5	.	.	2	13	.	.	.	20	118	39	13	.	170	.	2	192
	275	331	.	305	222	3	1	.	1137	355	377	192	162	1086	27	60	2310
Station II.																	
Jan. 17,	2	3	.	1	5	.	.	.	11	24	4	2	.	30	1	1	43
Feb. 21,	5	1	.	10	7	2	.	.	25	.	.	.	.	.	.	.	25
April 19,	16	9	.	16	2	2	.	.	45	3	2	.	25	30	1	6	82
May 31,	19	13	.	34	6	.	.	.	72	4	.	.	32	36	1	.	109
June 17,	46	19	.	64	24	.	.	.	153	3	38	3	30	74	.	.	227
July 28,	34	45	.	258	31	.	.	.	368	2	69	8	17	96	.	3	467
Aug. 25,	36	25	.	288	22	.	.	.	371	6	123	5	21	155	2	1	529
Sept. 20,	49	24	.	273	49	.	.	.	395	2	40	8	11	61	1	.	457
Oct. 25,	56	14	.	39	18	.	.	.	127	8	127	13	12	160	.	.	287
Nov. 16,	14	11	.	12	8	.	.	.	45	.	.	.	.	.	2	.	47
Dec. 21,	3	.	.	4	5	.	.	.	12	12	4	.	.	16	2	.	30
	280	164	.	999	177	4	.	.	1624	64	407	39	148	658	10	11	2303
Station III.																	
Jan. 16,	6	6	.	3	10	.	.	.	25	52	.	9	.	61	1	5	92
Feb. 20,	1	23	.	6	20	.	.	.	50	51	2	11	.	64	3	6	123
April 19,	50	37	.	57	25	2	.	.	171	27	145	9	11	192	3	14	380
May 24,	82	16	.	22	20	.	.	.	140	24	6	9	57	96	.	6	242
June 16,	123	30	.	35	9	.	.	.	197	16	83	11	15	125	.	3	325
July 31,	79	79	.	119	4	.	.	.	281	76	195	12	7	290	.	4	575
Aug. 24,	72	85	.	102	1	.	.	.	260	45	206	21	55	327	7	1	595
Sept. 21,	34	57	.	91	35	.	1	.	218	31	51	23	21	126	3	9	356
Oct. 27,	8	30	.	11	9	.	.	.	58	20	30	16	6	72	3	1	134
Nov. 14,	6	13	.	34	38	.	.	.	91	17	11	1	1	30	3	2	126
Dec. 26,	3	8	.	2	25	.	.	.	38	78	23	13	.	114	.	4	156
	464	384	.	482	196	2	1	.	1529	437	752	135	173	1497	23	55	3104

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1893—*continued.*

Station and Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
Firth of Forth—*continued.*																	
Station IV.																	
Jan. 24,	160	1	.	18	1	1	.	.	181	.	.	.	.	.	.	.	181
Feb. 17,	123	.	.	9	1	.	.	.	133	3	.	2	.	5	.	.	138
April 20,	175	4	.	62	1	4	.	.	246	.	.	2	17	19	14	10	289
May 23,	107	7	.	24	1	.	.	.	139	17	1	5	50	73	1	3	216
June 19,	77	8	.	14	1	.	.	.	100	22	242	67	35	366	2	7	475
Aug. 1,	9	.	.	7	.	.	.	.	16	5	7	2	1	15	2	.	33
Aug. 25,	64	5	.	33	1	.	.	.	103	4	7	1	.	12	7	.	122
Sept. 22,	202	15	.	161	6	1	.	.	385	23	74	10	99	206	9	3	603
Oct. 24,	72	1	.	6	.	.	.	.	79	.	.	.	2	2	.	1	82
Nov. 15,	51	3	.	24	12	.	.	.	90	2	.	.	.	2	.	2	94
Dec. 19,	212	.	.	7	1	7	.	.	227	3	.	.	.	3	.	.	230
	1252	44	.	365	25	13	.	.	1699	79	331	89	204	703	35	26	2463
Station V.																	
Feb. 6,	4	.	4	2	.	.	.	.	10	5	34	3	.	42	2	2	56
Mar. 2,	3	1	7	4	88	1	.	.	104	21	23	34	.	78	.	1	183
April 18,	6	1	.	7	29	.	.	.	43	10	24	8	2	44	.	1	88
May 30,	20	3	6	2	34	.	.	.	65	11	80	1	14	106	1	1	173
June 13,	27	6	3	13	46	.	.	.	95	12	65	5	9	91	3	.	189
July 28,	66	20	7	42	61	1	.	.	197	15	856	8	28	907	1	1	1106
Aug. 29,	20	2	1	15	62	.	.	.	100	12	581	15	71	679	.	.	779
Sept. 18,	23	7	1	32	123	.	.	.	186	6	454	14	16	490	1	2	679
Oct. 31,	57	6	8	43	55	.	.	.	169	13	427	5	9	454	3	1	627
Nov. 27,	1	2	4	9	12	.	.	.	28	12	250	1	.	263	3	.	294
Dec. 28,	2	1	2	1	29	.	.	.	35	18	197	20	.	235	4	.	274
	229	49	43	170	539	2	.	.	1032	135	2991	114	149	3389	18	9	4448
Station VI.																	
Jan. 20,	62	18	.	2	1	.	.	1	84	4	1	1	.	6	.	1	91
Mar. 2,	67	.	.	8	1	1	.	3	80	12	3	1	.	16	.	6	102
April 18,	20	17	.	8	.	.	.	.	45	33	4	.	.	37	.	2	84
May 31,	24	25	.	8	.	.	.	.	57	.	3	.	121	124	.	6	187
June 19,	18	9	.	39	.	.	.	.	66	6	57	37	28	128	.	2	196
July 28,	69	27	.	56	6	.	.	1	159	10	85	19	21	135	1	1	*296
Aug. 30,	8	14	.	23	.	.	.	.	45	43	136	13	13	205	.	1	251
Sept. 26,	90	18	.	45	.	.	.	6	159	1	42	.	2	45	.	1	205
Oct. 31,	88	16	.	49	.	.	.	1	154	6	2	.	3	11	1	2	168
Nov. 27,	47	8	.	3	2	.	.	.	60	19	5	4	.	28	.	.	88
Dec. 29,	16	2	.	6	2	.	.	2	28	4	.	.	.	4	.	.	32
	509	154	.	247	12	1	.	14	937	138	338	75	188	739	2	22	1700
Station VII.																	
Jan. 25,	3	1	.	3	39	1	1	.	48	1	49	2	.	52	1	.	101
Feb. 28,	1	.	.	.	.	.	.	.	1	2	11	1	.	14	2	1	18
April 17,	34	10	.	54	24	11	.	.	133	7	52	.	61	120	7	1	261
May 24,	11	11	.	48	9	.	.	.	79	.	55	3	57	115	.	1	195
June 14,	60	16	.	104	31	.	.	.	211	4	146	5	41	196	.	6	413
Aug. 1,	37	6	.	240	21	.	.	.	304	2	796	18	24	840	3	2	1149
Aug. 28,	44	9	1	293	9	.	.	.	356	6	1333	56	40	1435	7	7	1805
Sept. 26,	7	1	2	31	14	.	.	.	55	20	554	11	1	586	6	2	649
Oct. 24,	6	.	9	26	35	.	.	.	76	7	569	31	1	608	1	1	686
Nov. 21,	1	3	.	21	8	.	.	.	33	29	281	6	.	316	5	4	358
Dec. 28,	2	.	2	4	17	.	.	.	25	13	108	30	.	151	.	2	178
	206	57	14	824	207	12	1	.	1321	91	3954	163	225	4433	32	27	5813

* One Black Sole.

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1893—*continued.*

Station and Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
FIRTH OF FORTH—*continued.*																	
Station VIII.																	
Jan. 25,	2	1	3	8	32	.	.	.	46	4	85	4	.	93	.	.	139
Feb. 24,	1	2	.	1	5	.	.	.	9	4	6	3	.	13	2	2	26
April 14,	2	3	.	42	37	4	.	.	88	2	105	7	32	146	1	1	236
May 30,	5	3	6	17	14	.	.	.	45	4	27	2	40	73	.	3	121
June 14,	6	1	1	8	27	.	.	.	43	7	12	8	20	47	3	2	95
July 27,	13	20	8	29	43	.	.	.	113	18	85	11	36	150	4	6	273
Aug. 29,	1	13	2	11	48	.	.	.	75	8	736	21	25	790	.	2	867
Sept. 18,	7	4	7	32	51	.	.	.	101	7	503	1	18	529	4	1	635
Oct. 30,	3	6	7	5	19	.	1	.	41	12	93	1	4	110	3	1	155
Dec. 27,	.	.	2	6	13	.	.	.	21	18	84	62	.	164	.	1	186
	40	53	36	159	289	4	1	.	582	84	1736	120	175	2115	17	19	2733
Station IX.																	
Jan. 18,	.	.	.	14	45	.	.	.	59	3	135	1	.	139	6	1	205
Feb. 24,	1	.	.	32	122	.	2	.	157	3	130	10	.	143	1	.	301
Apr. 14,	.	.	.	7	2	.	.	.	9	.	36	3	3	42	1	4	56
June 2,	.	2	2	3	22	.	.	.	29	4	84	3	4	95	2	.	126
June 14,	1	.	2	6	18	.	.	.	27	22	236	9	2	269	.	.	296
July 27,	.	.	.	2	63	.	.	.	65	7	140	10	27	184	3	1	253
Aug. 29,	5	.	.	7	62	.	.	.	74	18	756	53	36	863	1	3	941
Oct. 30,	5	5	1	2	18	.	.	.	31	5	57	2	1	65	3	1	100
Dec. 27,	.	.	4	2	13	.	.	.	19	4	39	11	.	54	.	1	74
	12	7	9	75	365	.	2	.	470	66	1613	102	273	1854	17	11	2352
Station X.																	
Jan. 21,	1	1	.	2	5	.	.	.	9	10	.	14	.	24	6	13	52
Feb. 23,	1	.	.	.	.	.	.	.	1	2	.	3	.	5	.	1	7
April 21,	.	1	.	.	.	.	.	.	1	.	.	6	.	6	13	1	21
May 29,	1	2	.	.	.	.	.	.	3	8	.	7	.	15	8	2	28
June 20,	.	.	.	.	.	.	.	.	.	9	.	10	.	19	7	1	27
Nov. 17,	1	.	.	1	.	1	.	.	3	7	.	4	.	11	6	.	20
	4	4	.	3	5	1	.	.	17	36	.	44	.	80	40	18	155
ST ANDREWS BAY—																	
Station I.																	
Jan. 12,	2	.	.	.	.	.	.	.	2	4	.	2	.	6	.	.	8
Feb. 7,	4	.	.	4	.	1	.	.	9	.	.	.	.	.	.	.	9
Mar. 8,	27	.	.	20	1	5	.	.	53	.	.	.	.	.	1	1	55
June 8,	66	1	.	96	.	1	1	.	165	.	18	2	102	122	2	.	289
July 5,	70	.	.	.	1	1	.	.	72	47	15	8	19	89	1	.	162
Nov. 8,	5	.	.	15	.	.	.	.	20	8	58	2	.	68	1	.	89
	174	1	.	135	2	8	1	.	321	59	91	14	121	285	5	1	612
Station II.																	
Jan. 12,	1	.	.	.	.	.	.	.	1	4	.	.	.	4	.	.	5
Feb. 8,	.	.	.	1	.	.	.	.	1	1	.	.	.	1	2	.	4
Mar. 9,	5	.	.	.	.	3	.	.	8	.	.	.	.	.	.	.	8
June 9,	96	1	.	33	.	.	.	.	130	.	86	3	99	188	2	3	323
July 7,	159	.	.	24	2	1	.	.	186	.	18	2	14	34	1	.	221
Nov. 9,	1	1	.	14	2	.	.	.	18	2	83	2	.	87	.	1	106
	262	2	.	72	4	4	.	.	344	7	187	7	113	314	5	4	667

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1893—*continued.*

Station and Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
St Andrews Bay—*continued.*																	
Station III.																	
Jan. 13,	.	.	.	1	3	.	.	.	4	4	.	3	.	7	.	.	11
Feb. 7,	.	.	.	1	.	1	.	.	2	.	.	2	.	2	.	.	4
Mar. 8,	26	.	.	7	.	2	.	.	35	.	.	.	.	.	.	1	36
June 9,	180	.	.	9	9	2	1	.	201	.	14	1	32	47	4	.	252
July 5,	218	.	.	35	6	1	.	.	260	.	83	1	5	89	.	1	350
Nov. 9,	.	.	.	4	3	.	.	.	7	9	19	.	.	28	2	.	37
	424	.	.	57	21	6	1	.	509	13	116	7	37	173	6	2	690
Station IV.																	
Jan. 13,	9	.	.	5	.	.	.	.	14	1	.	16	.	17	.	4	35
Feb. 8,	26	.	.	2	.	1	.	.	29	.	.	2	.	2	2	.	33
Mar. 8,	337	.	.	9	.	7	.	.	353	.	.	.	.	.	3	.	356
June 9,	276	1	.	179	.	8	.	.	464	.	56	3	25	84	.	1	549
July 7,	217	1	.	159	.	4	.	.	381	.	115	1	12	128	3	.	512
Nov. 9,	33	.	.	17	1	1	.	.	52	11	6	34	.	51	.	1	104
	898	2	.	371	1	21	.	.	1293	12	177	56	37	282	8	6	1589
Station V.																	
Jan. 13,	.	.	.	2	1	.	1	.	4	.	1	1	.	2	1	.	7
Feb. 8,	1	.	.	5	2	.	.	.	8	.	.	.	.	.	1	.	9
Mar. 8,	3	.	.	13	2	7	.	.	25	.	1	.	.	1	1	.	27
June 8,	7	5	.	34	3	14	.	.	63	.	6	1	66	73	2	2	140
July 5,	15	2	.	48	2	4	.	.	71	.	4	6	26	36	.	.	107
Nov. 8,	4	.	.	7	1	.	.	.	12	5	251	1	.	257	.	1	270
	30	7	.	109	11	25	1	.	183	5	263	9	92	369	5	3	560
Station VI.																	
June 7,	2	4	.	51	7	.	.	.	64	.	5	1	11	17	10	2	93
July 4,	9	4	.	82	32	2	.	.	129	.	19	3	26	48	8	1	186
	11	8	.	133	39	2	.	.	193	.	24	4	37	65	18	3	279
Montrose—																	
Station I.																	
Jan. 14,	2	1	.	2	3	.	.	.	8	18	2	2	.	22	.	.	30
Feb. 13,	1	.	.	.	4	.	.	.	5	6	.	3	.	9	3	.	17
May 19,	42	.	.	19	16	.	.	.	77	4	52	5	255	316	2	2	397
	45	1	.	21	23	.	.	.	90	28	54	10	255	347	5	2	444
Station II.																	
Jan. 14,	.	.	.	.	.	.	.	.	.	5	1	6	.	12	.	.	12
Feb. 13,	1	.	.	.	.	.	.	.	1	5	.	2	.	7	3	.	11
May 19,	17	1	.	29	4	.	.	.	51	.	81	2	472	555	1	2	609
	18	1	.	29	4	.	.	.	52	10	82	10	472	574	4	2	632

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1893—*continued.*

Station and Date.	Flat-Fish.									Round Fish.							
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.	Skate.	Other Fish.	Total.
ABERDEEN—																	
Station I.																	
Feb. 11, .	20	1	.	5	3	.	.	.	29	.	3	2	1	6	1	.	36
May 16, .	47	7	.	40	13	.	.	.	107	.	23	.	.	23	2	.	132
	67	8	.	45	16	.	.	.	136	.	26	2	1	29	3	.	168
Station II.																	
Feb. 11, .	12	.	.	2	3	.	.	.	17	.	12	.	196	208	.	.	225
May 16, .	42	3	.	49	12	1	.	.	107	1	103	11	148	263	.	.	370
	54	3	.	51	15	1	.	.	124	1	115	11	344	471	.	.	595
Station III.																	
Feb. 10, .	13	.	.	1	.	.	.	.	14	.	4	.	.	4	3	.	21
May 16, .	51	.	.	53	15	.	.	.	119	.	79	16	144	239	1	.	359
	64	.	.	54	15	.	.	.	133	.	83	16	144	243	4	.	380
Station IV.																	
Feb. 10, .	19	.	.	.	.	.	.	.	19	.	.	.	.	.	3	.	22
May 17, .	21	1	.	10	11	.	.	.	43	2	221	43	140	406	.	.	449
	40	1	.	10	11	.	.	.	62	2	221	43	140	406	3	.	471
Station V.																	
Feb. 10, .	25	.	.	.	.	1	.	.	26	10	8	1	.	19	10	4	59
May 17, .	7	1	.	2	1	.	.	.	11	.	191	17	10	218	2	.	231
	32	1	.	2	1	1	.	.	37	10	199	18	10	237	12	4	290
Station VI.																	
Feb. 9, .	7	.	.	.	.	.	.	.	7	3	8	1	.	12	4	.	23
May 17, .	5	1	.	3	.	.	.	.	9	.	48	5	6	59	2	.	70
	12	1	.	3	.	.	.	.	16	3	56	6	6	71	6	.	93
Station VII.																	
Feb. 9, .	6	.	.	.	.	.	.	.	6	5	1	1	.	7	.	.	13
May 17, .	37	1	.	20	.	.	.	.	58	6	17	1	50	74	.	.	132
	43	1	.	20	.	.	.	.	64	11	18	2	50	81	.	.	145

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1893—*continued.*

Station and Date.	Flat-Fish.								Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
Moray Firth—																	
Station I.																	
April 29,	19	.	.	14	.	.	.	.	33	.	.	.	2	2	.	.	35
Oct. 3,	39	.	.	299	2	.	.	1	341	1	4	.	10	15	1	2	359
	58	.	.	313	2	.	.	1	374	1	4	.	12	17	1	2	394
Station II.																	
May 3,	4	.	8	26	17	.	.	.	55	.	.	.	19	19	.	1	75
Oct. 3,	52	3	11	76	28	.	.	.	170	3	230	32	24	289	6	2	467
	56	3	19	102	45	.	.	.	225	3	230	32	43	308	6	3	542
Station III.																	
May 3,	21	2	.	8	.	.	.	.	31	4	.	.	1	5	3	1	40
Oct. 5,	65	6	.	3	.	.	.	.	74	11	3	.	1	15	.	.	89
	86	8	.	11	.	.	.	.	105	15	3	.	2	20	3	1	129
Station IV.																	
May 2,	17	1	.	24	.	.	.	.	42	.	.	.	.	.	.	1	43
Oct. 6,	524	3	.	198	1	.	.	1	727	.	76	2	24	102	.	.	829
	541	4	.	222	1	.	.	1	769	.	76	2	24	102	.	1	872
Station V.																	
May 2,	15	.	.	87	.	.	.	.	102	1	.	.	85	86	.	.	188
Oct. 6,	229	8	.	387	5	.	.	.	629	2	48	.	34	84	1	1	715
	244	8	.	474	5	.	.	.	731	3	48	.	119	170	1	1	903
Station VI.																	
May 2,	8	1	.	45	.	.	.	.	54	8	4	.	15	27	1	1	83
Oct. 6,	420	9	.	411	.	.	.	.	840	.	14	.	57	71	2	3	916
	428	10	.	456	.	.	.	.	894	8	18	.	72	98	3	4	999
Station VII.																	
May 10,	11	6	.	20	.	.	.	.	37	24	45	1	32	102	1	2	142
May 10,	1	.	.	30	.	.	.	.	31	1	4	21	18	44	.	69	144
Oct. 16,	22	4	.	117	.	.	.	.	143	.	50	2	28	80	.	1	224
	34	10	.	167	.	.	.	.	211	25	99	24	78	226	1	72	510
Station VIII.																	
May 10,	9	17	.	33	.	.	.	.	59	23	301	7	72	403	.	1	463
Oct. 16,	25	1	.	38	.	.	.	.	64	8	78	1	25	112	.	3	179
	34	18	.	71	.	.	.	.	123	31	379	8	97	515	.	4	642

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1893—*continued.*

Station and Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
Moray Firth —*continued.*																	
Station IX.																	
May 10,	6	19	.	40	3	.	.	.	68	9	115	6	40	170	1	1	240
May 10,	1	3	.	19	2	.	.	.	25	1	170	144	18	333	.	4	362
Oct. 17,	10	35	.	20	2	.	.	.	67	6	30	.	3	39	.	.	106
	17	57	.	79	7	.	.	.	160	16	315	150	61	542	1	5	708
Station X.																	
May 10,	1	.	.	32	6	.	.	.	39	.	83	3	14	100	1	.	140
Oct. 17,	2	8	.	34	10	.	.	.	54	2	15	8	12	37	3	1	95
	3	8	.	66	16	.	.	.	93	2	98	11	26	137	4	1	235
Station XI.																	
May 10,	7	1	.	24	1	.	.	.	33	1	8	1	28	38	1	2	74
Oct. 16,	17	33	.	195	.	.	.	.	245	7	108	.	34	149	.	8	402
	24	34	.	219	1	.	.	.	278	8	116	1	62	187	1	10	476
Station XII.																	
May 11,	.	4	.	4	10	.	.	.	18	3	59	.	1	63	3	1	85
May 11,	.	3	.	22	16	.	.	.	41	.	4	.	.	4	.	2	47
Oct. 17,	4	11	.	63	.	.	.	.	78	12	328	5	82	427	4	8	517
	4	18	.	89	26	.	.	.	137	15	391	5	83	494	7	11	649
Station XIII.																	
May 8,	.	5	.	32	8	.	.	.	45	.	55	2	13	70	.	4	119
May 8,	.	.	.	48	33	.	.	.	81	1	83	3	2	89	.	9	179
Oct. 7,	8	1	8	222	60	.	.	.	299	2	385	11	36	434	.	5	738
	8	6	8	302	101	.	.	.	425	3	523	16	51	593	.	18	1036
Station XIV.																	
May 8,	3	3	1	147	21	.	.	.	175	2	98	10	33	143	3	2	323
May 8,	.	2	.	49	104	.	.	.	155	2	22	14	5	43	.	13	211
Oct. 10,	1	6	12	35	55	.	.	.	109	.	108	1	14	123	.	6	238
	4	11	13	231	180	.	.	.	439	4	228	25	52	309	3	21	772
Station XV.																	
May 8,	8	.	.	75	15	.	.	.	98	.	27	3	28	58	3	4	163
Oct. 10,	1	1	1	154	46	.	.	.	203	1	23	1	40	65	.	1	269
	9	1	1	229	61	.	.	.	301	1	50	4	68	123	3	5	432
Station XVI.																	
May 9,	10	2	.	42	.	.	.	1	55	13	7	.	1	21	.	2	78
Oct. 21.	11	10	.	69	.	.	.	.	90	5	25	1	38	69	2	4	165
	21	12	.	111	.	.	.	1	145	18	32	1	39	90	2	6	243

TABLE B.—ANALYSIS OF THE 'GARLAND'S' STATISTICS RELATING TO THE RELATIVE ABUNDANCE OF FISH.

A. SHOWING THE AVERAGE PER 'SHOT' OF EACH KIND OF FISH TAKEN.

Station.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Sole.	Witch Sole.	Common Dabs.	Long Roughs.	Flounder.	Turbot.	Brill.	Total.	Cod.	Haddock.	Whiting.	Gurnard.	Total.			
I. *Firth of Forth.*																	
Closed Area.																	
I.	25·0	30·1	–	21·7	20·2	0·27	0·09	–	103·4	32·3	34·3	17·4	14·7	98·7	2·4	5·5	210·0
II.	25·5	14·9	–	90·8	16·1	0·36	–	–	147·6	5·8	37·0	3·5	13·4	59·8	0·9	1·0	209·4
III.	42·2	34·9	–	43·8	17·8	0·18	0·09	–	139·0	39·7	68·4	12·3	15·7	136·1	2·1	5·0	282·2
IV.	113·8	4·0	–	33·2	2·3	1·2	–	–	154·5	7·2	30·1	8·1	18·5	63·9	3·2	2·4	223·9
V.	20·8	4·5	3·9	15·5	49·0	0·19	–	–	93·8	12·3	271·9	10·4	13·5	308·1	1·6	0·8	404·4
VI.	46·3	14·0	–	22·5	1·1	0·09	–	1·3	85·2	12·5	30·7	6·8	17·1	67·2	0·18	2·0	154·5
VII.	18·7	5·2	1·3	74·9	18·8	1·1	0·09	–	120·1	8·3	359·5	14·8	20·5	403·0	2·9	2·5	528·5
Average per shot of 77 shots.	41·7	15·4	0·7	44·1	17·9	0·5	0·04	0·2	120·5	16·8	118·8	10·5	16·2	162·4	1·9	2·7	287·6
Unclosed Area.																	
VIII.	4·0	5·3	3·6	15·9	28·9	0·4	0·1	–	58·2	8·4	173·6	12·0	17·5	211·5	1·7	1·9	273·3
IX.	1·3	0·77	1·0	8·3	40·6	–	0·22	–	52·2	7·3	179·2	11·3	8·1	206·0	1·9	1·2	261·3
Average per shot of 19 shots.	2·7	3·2	2·4	12·3	34·4	0·2	0·2	–	55·4	7·9	176·3	11·7	13·1	208·8	1·8	1·6	267·6
II. *St Andrews Bay.*																	
Closed Area.																	
I.	29·0	0·16	–	22·5	0·33	1·33	0·16	–	53·5	9·8	15·2	2·3	20·2	47·5	0·83	0·16	102·0
II.	43·6	0·33	–	12·0	0·66	0·66	–	–	57·3	1·2	31·2	1·2	18·8	52·3	0·83	0·66	111·2
III.	70·6	–	–	9·5	3·5	1·0	0·16	–	84·8	2·2	19·3	1·2	6·2	28·8	1·0	0·33	115·0
IV.	149·6	0·33	–	61·8	0·16	3·5	–	–	215·5	2·0	29·5	9·3	6·2	47·0	1·3	1·0	264·8
Average per shot of 24 shots.	73·2	0·2	–	26·5	1·2	1·6	0·08	–	102·8	3·8	23·8	3·5	12·8	43·9	1·0	0·5	148·2
Unclosed Area. V. Average of 6 shots.	5·0	1·2	–	18·2	1·8	4·2	0·16	–	30·5	0·83	43·8	1·5	15·3	61·5	0·83	0·5	93·3

A. Showing the Average Per 'Shot' of each kind of Fish taken—*continued.*

Station.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Sole.	Witch Sole.	Common Dabs.	Long Roughs.	Flounder.	Turbot.	Brill.	Total.	Cod.	Haddock.	Whiting.	Gurnard.	Total.			
III. *Montrose.*																	
I.	22·5	0·5	–	10·5	11·5	–	–	–	45·0	14·0	27·0	5·0	127·5	173·5	2·5	1·0	222·0
II.	9·0	0·5	–	14·5	2·0	–	–	–	26·0	5·0	41·0	5·0	236·0	287·0	2·0	1·0	316·0
Average of 4 shots.	15·7	0·5	–	12·5	6·7	–	–	–	35·5	9·5	34·0	5·0	181·7	230·2	2·2	1·0	269·0
IV. *Aberdeen.*																	
I.	33·5	4·0	–	22·5	8·0	–	–	–	68·0	–	13·0	1·0	0·5	14·5	1·5	–	84·0
II.	27·0	1·5	–	25·5	7·5	0·5	–	–	62·0	0·5	57·5	5·5	172·0	235·5	–	–	297·5
III.	32·0	–	–	27·0	7·5	–	–	–	66·5	–	41·5	8·0	72·0	121.5	2·0	–	190·0
IV.	20·0	0·5	–	5·0	5·5	–	–	–	31·0	1·0	110·5	21·5	70·0	203·0	1·5	–	235·5
V.	16·0	0·5	–	1·0	0·5	0·5	–	–	18·5	5·0	99·5	9·0	5·0	118·5	6·0	2·0	145·0
VI.	6·0	0·5	–	1·5	–	–	–	–	8·0	1·5	28·0	3·0	3·0	35·5	3·0	–	46·5
VII.	21·5	0·5	–	10·0	–	–	–	–	32·0	5·5	9·0	1·0	25·0	40·5	–	–	72·5
Average per shot of 14 shots.	22·3	1·1	–	13·2	4·1	0·14	–	–	40·8	1·9	51·3	7·0	49·6	109·8	2·0	0·3	153·0
V. *Moray Firth.*																	
I.	29·0	–	–	156·5	1·0	–	–	0·5	187.0	0·5	2·0	–	6·0	8·5	0·5	1·0	197·0
II.	28·0	1·5	9·5	51 0	22·5	–	–	–	112·5	1·5	115·0	16·0	21·5	152·0	3·0	1·5	271·0
III.	43·0	4·0	–	5·5	–	–	–	–	52·5	7·5	1·5	–	1·0	10·0	1·5	0·5	64·5
IV.	270.5	2·0	–	111·0	0·5	–	–	0·5	384 5	–	38·0	1·0	12·0	51·0	–	0·5	436·0
V.	122·0	4·0	–	237·0	2·5	–	–	–	365·5	1·5	24·0	–	59·5	85·0	0·5	0·5	451·5
VI.	214·0	5·0	–	228·0	–	–	–	–	447·0	4·0	9·0	–	36·0	49·0	1·5	2·0	499·5
VII.	11·3	3·3	–	55·6	–	–	–	–	70·3	8·6	33·0	8·0	26·0	75·3	0·3	24·0	170·0
VIII.	17·0	9·0	–	35·5	–	–	–	–	61·5	1 55	189·5	4·0	48·5	257·5	–	2·0	321·0
IX.	5·6	19·0	–	26·3	2·3	–	–	–	53·3	5·3	105·0	50·0	20·3	180·6	0·3	1·6	236·0
X.	1·5	4·0	–	33·0	8·0	–	–	–	46·5	1·0	49·0	5·5	13·0	68·5	2·0	0·5	117·5
XI.	12·0	17·0	–	109·5	0·5	–	–	–	139 0	4·0	58·0	0·5	31·0	93·5	0·5	5·0	238·0
XII.	1·3	6·0	–	29·6	8·6	–	–	–	45·6	5·0	130.3	1·6	27·6	164·6	2·3	3·6	216·3
XIII.	2·6	2·0	2·6	100·6	33·6	–	–	–	141·6	1·0	174·3	5·3	17·0	197·6	–	6·0	345·3
XIV.	1·3	3·6	4·3	77·0	60·0	–	–	–	146·3	1·3	76·0	8·3	17·3	103·0	1·0	7·0	257·3
XV.	4·5	0·5	0·5	114·5	30·5	–	–	–	150 5	0·5	25·0	2·0	34·0	61·5	1·5	2·5	216·0
XVI.	10·5	6·0	–	55·5	–	–	–	0·5	72·5	9·0	16·0	0·5	19·5	45·0	1·0	3·0	121·5
Average per shot of 37 shots.	42·5	5·6	1·1	84·9	12·0	–	–	0·08	146·2	4·1	70·5	7·5	25·4	106·3	1·0	4·5	257·9

B. Showing the Monthly Average Per 'Shot' of each kind of Fish taken in 1893.

Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Sole.	Witch Sole.	Common Dabs.	Long Roughs.	Flounder.	Turbot.	Brill.	Total.	Cod.	Haddock.	Whiting.	Gurnard.	Total.			
I. *Firth of Forth.*																	
Closed Area.																	
Jan.	33·8	5·3	0·6	4·4	14·2	0·3	0·14	0·14	58·8	21·4	12·6	5·7	–	39·7	1·7	1·7	102·0
Feb.	29·2	5·3	1·0	6·0	19·2	0·6	–	0·4	61·6	16·7	5·6	7·6	–	29·8	1·4	3·2	96·0
April	45·0	16·3	–	36·0	13·6	3·1	–	–	114·0	13·3	33·7	3·3	18·8	69·1	3·8	5·6	192·6
May	40·3	13·6	0·8	23·8	11·8	–	–	–	90·4	8·8	21·6	3·0	53·3	86·7	0·6	4·6	182·3
June	53·0	17·0	0·4	39·7	16·7	–	–	–	126·8	11·7	97·0	18·6	25·3	152·6	1·0	3·1	283·6
July	49·8	33·0	1·0	109·6	22·1	0·1	0·1	0·1	216·0	19·1	307·0	17·0	17·0	361·6	1·0	2·4	581·0
Aug.	44·4	29·8	0·3	117·4	18·7	–	–	–	210·6	20·9	321·8	25·8	34·4	432·0	2·7	2·0	634·9
Sept.	64·8	26·3	0·4	96·1	34·1	0·1	0·1	0·9	223·0	12·6	173·8	9·4	23·7	219·6	2·9	3·1	448·6
Oct.	46·4	13·3	2·4	27·4	18·9	–	–	0·1	108·6	10·7	172·3	12·0	5·6	200·6	1·6	1·0	311·7
Nov.	17·7	7·7	0·6	20·3	14·4	–	–	–	60·7	13·7	80·1	2·0	0·3	96·1	2·7	2·1	161·7
Dec.	34·7	1·6	0·6	3·7	13·1	1·0	–	0·3	55·0	35·1	53·0	10·9	–	99·0	0·9	1·1	156·0
Unclosed Area.																	
Jan.	1·0	0·5	1·5	11·0	38·5	–	–	–	52·5	3·5	110·0	2·5	–	116·0	3·0	0·5	172·0
Feb.	1·0	1·0	–	16·5	63·5	–	1·0	–	83·0	3·5	68·0	6·5	–	78·0	1·5	1·0	163·5
April	1·0	1·5	–	24·5	19·5	2·0	–	–	48·5	1·0	70·5	5·0	17·5	94·0	1·0	2·5	146·0
May	2·5	2·5	4·0	10·0	18·0	–	–	–	37·0	4·0	55·5	2·5	22·0	84·0	1·0	1·5	123·5
June	3·5	0·5	1·5	7·0	22·5	–	–	–	35·0	14·5	124·0	8·5	11·0	158·0	1·5	1·0	195·5
July	6·5	10·0	4·0	15·5	53·0	–	–	–	89·0	12·5	112·5	10·5	31·5	167·0	3·5	3·5	263·0
Aug.	3·0	6·5	1·0	9·0	55·0	–	–	–	74·5	13·0	746·0	37·0	30·5	826·5	0·5	2·5	904·0
Sept.	7·0	4·0	7·0	32·0	51·0	–	–	–	101·0	7·0	503·0	1·0	18·0	529·0	4·0	1·0	635·0
Oct.	4·0	5·5	4·0	3·5	18·5	–	0·5	–	36·0	8·5	75·0	1·5	2·5	87·5	3·0	1·0	127·5
Dec.	–	–	3·0	4·0	13·0	–	–	–	40·0	11·0	61·5	36·5	–	109·0	–	1·0	130·0
II. *St Andrews Bay.*																	
Closed Area.																	
Jan.	3·0	–	–	1·5	0·8	–	–	–	5·3	3·3	–	5·3	–	8·5	–	1·0	14·8
Feb.	7·5	–	–	2·0	–	0·7	–	–	10·3	0·3	–	1·0	–	1·3	1·0	–	12·5
Mar.	98·7	–	–	9·0	0·3	4·3	–	–	112·2	–	–	–	–	–	1·0	0·5	113·7
June	154·5	0·7	–	79·2	2·2	2·7	0·5	–	240·0	–	43·5	2·3	64·5	110·2	2·0	1·0	353·3
July	166·0	0·3	–	54·5	2·3	1·7	–	–	224·7	11·8	57·8	3·0	12·5	85·0	1·3	0·3	311·3
Nov.	9·8	0·3	–	12·5	1·5	0·3	–	–	24·3	7·5	41·5	9·5	–	58·5	0·8	0·5	84·0
Unclosed Area.																	
Jan.	–	–	–	2·0	1·0	–	1·0	–	4·0	–	1·0	1·0	–	2·0	1·0	–	7·0
Feb.	1·0	–	–	5·0	2·0	–	–	–	8·0	–	–	–	–	–	1·0	–	9·0
Mar.	3·0	–	–	13·0	2·0	7·0	–	–	25·0	–	1·0	–	–	1·0	1·0	–	27·0
June	4·5	4·5	–	42·5	5·0	7·0	–	–	63·5	–	5·5	1·0	38·5	45·0	6·0	2·0	116·5
July	12·0	3·0	–	65·0	17·0	3·0	–	–	100·0	–	11·5	4·5	26·0	42·0	4·0	0·5	146·5
Nov.	4·0	–	–	7·0	1·0	–	–	–	12·0	5·0	251·0	1·0	–	257·0	–	1·0	270·0

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth.

E. before the figures indicating temperature means east end of station; W., west; N., north; and S., south.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 17th Jan. 1893. 1.40 p.m. to 3.50 p.m.	E. 44·5	39·7	40·1 16½ fath.	Surface Tow-net. — Euphausidæ, f.; *Parathemisto*, sp. f.; *Hyperoche*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, fr.	Thornback rays,	1	23	1	20	1	15	*Buccinum undatum*, r.; *Nephrops norvegicus*, f.; *Asterias*, sp. fr.; *Solaster papposa*, fr.; *Alcyonium*, sp. f.	At beginning—Wind N.W., force 4; weather, slight haze; sea, choppy; tide, 5¼ hours flood; barometer, 29·71; transparency, 3 fathoms.
					,, ,,	4	9–11½	...	...	...	...		
					Lemon soles,	2	14½	5	12	1	9		
					Common dabs,	1	11	1	7	...	...		
					Long rough dabs,	3	10	10	8	14	7		
					,, ,,	16	6	...	...	...	...		
	W. 42·0	38·8	39·5 15 fath.	Bottom Tow-net. — *Crangon*, sp. r.; Euphausidæ, c.; *Gastrosaccus spinifer*, r.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, c.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Tomopteris*, sp. f.; Ctenophora, fr.	Cod,	1	29	1	26	4	22½		At finish—Wind W.N.W., force 3; weather, hazy; sea, slight; tide, 1½ hours ebb; barometer, 29·71; transparency, 2¾ fathoms.
					,,	1	18½	4	12–14½	2	9		
					,,	43	6–7	8	4½	...	...		
					Whitings,	2	9	4	8	15	6½		
					,,	2	5	...	...	...	...		
					Anglers,	1	25	1	20	1	14		
Station II. 17th Jan. 1893. 11 0 a.m. to 1.45 p.m.	W. 44·0	38·8	39·2 13⅜ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, f.	Grey skate,	1	8½	...	...	...	...	*Cancer pagurus*, r.; *Buccinum undatum*, r.; *Nephrops norvegicus*, f.; *Pandalus annulicornis*, f.; *Asterias*, fr.; *Solaster pap-*	At beginning—Wind N.W., force 2; weather, hazy; sea, easterly swell; tide, 2¾ hours flood; barometer, 29·70; transparency, 2½ fathoms. At finish—Wind W.N.W., force 2;
					Plaice,	1	12	1	11	...	...		
					Lemon soles,	1	15	1	13½	1	10½		
					Common dabs,	1	7	...	...	...	...		
	E. 46·0	39·2	40·8 16 fath.	Bottom Tow-net.—*Crangon*, sp. f.; *Pandalus annulicornis*, r.; *Virbius*, sp. f.; Euphausidæ, fr.; *Mysis*, sp. f.; *Mysidopsis gibbosa*, r.; *Erythrops*, sp. f.; *Cala-*	Long rough dabs,	1	10½	1	8½	2	7⅛		
					,, ,,	1	6⅞	...	...	...	...		
					Haddocks,	2	17½	1	16½	1	14		
					Cod,	3	34	3	32	1	29		
					,,	10	26½	5	23½	1	22		

* sp. = species unidentified; juv. = young; r. = rare; f. = few; fr. = frequent; com. = common; a. = abundant; v.a. = very abundant.
† The measurement of skates and rays is a measurement of width, and not of length.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
				nus finmarchicus, fr.; *Caligus*, sp. f.; Ctenophora, *Sagitta*, sp. c.	Cod, . . .	1	20	...	...	...	...	*posa*, fr.; *Ophiothrix rosula*, f.	weather, moderately clear; sea, slight; tide, 4½ hours flood; barometer, 29·70; transparency, 3 fathoms.
					Whitings, . .	2	6	...	...	...	...		
					Catfish, . .	1	28	...	...	...	...		
Station II. 17th Jan. 1893. 11.0 a.m. to 12.45 p.m. —*continued.*													
Station III. 16th Jan. 1893. 12.10 p.m. to 2.50 p.m.	E. 41·0	36·3	36·6 8½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. r.; Ctenophora, fr.	Grey skate, .	1	18½	...	...	...	...	*Fusus antiquus*, r.; *Pecten opercularis*, fr.; *Asterias*, sp. f.; *Solaster papposa*, f.; *Ophiothrix rosula*, f.; *Echinus esculentus*, fr.; *Actinoloba dianthus*, fr.	At beginning—Wind W.N.W., force 2; weather, hazy; sea, slight; tide, 4½ hours flood; barometer, 29·64; transparency, 2½ fathoms.
					Plaice, . .	4	15½	1	14½	1	13		
					Lemon soles, .	2	13	1	12	2	11		
					,, ,, .	1	9	...	...	...	...		
	W. 44·0	37·5	39·7 10 fath.	Bottom Tow-net.—*Thysanoessa*, sp. fr.; *Mysis* sp. (*spiritus*?) c.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Caligus rapax*, fr.; *Sagitta*, sp. ab.; *Tomopteris*, fr.; Ctenophora, fr.	Common dabs, .	1	10	1	9	1	7½		At finish—Wind N.W. by W., force 2; weather, slight haze; sea, as before; tide, 1 hour ebb; barometer, 29·67; transparency, 2½ fathoms.
					Long rough dabs,	2	11	1	9	2	8		
					,, ,,	5	6–7	...	...	...	...		
					Cod, . . .	1	3	3	24–27	11	18–22		
					,, . . .	4	15–17	13	7½–8½	20	5½–6½		
					Whitings, . .	1	8½	5	6½	3	5½		
					Catfish, . .	1	38	1	27	1	22		
					Anglers, . .	1	14½	...	...	...	...		
					Father-lasher, .	1	6	...	...	...	...		
Station IV. 24th Jan. 1893. 10.45 a.m. to 1.50 p.m.	W. 46·0	39·5	40·1 4¾ fath.	Surface Tow-net.—Euphausidæ, f.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. fr.; Ctenophora, fr.	Plaice, . .	37	15–17	71	13–14	43	11–12	*Pecten opercularis*, f.; *Mytilus modiolus*, fr.; *Buccinum undatum*, r.; *Hyas araneus*, f.; *Asterias*, f.; *Ophiothrix rosula*, f.; *Chalina*, fr.; *Alcyonium*, sp. f.	At beginning—Wind W.S.W., force 6; weather, hazy; sea, rough; tide, 4 hours ebb; barometer, 29·74; transparency, 2 fathoms.
					,, . .	9	10	..	...	...	...		
					Lemon soles, .	1	11	...	...	...	...		
					Common dabs, .	2	11	3	10	4	9		
	E. 45·0	39·5	39·9 6 fath.	Bottom Tow-net.—*Macropsis slabberi*, r.; *Mysis lamornæ*, r.; *Idotea linearis*, r.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, ab.; *Sagitta*, sp. fr.; *Tomopteris*, r.; Ctenophora, fr.; young Herring, r.	,, ,, .	9	5–8	...	...	...	...		At finish — Wind, weather and sea as before; tide, 1 hour flood; barometer, 29·70; transparency, 1½ fathoms.
					Flounder, . .	1	13½	...	...	...	...		
					Long rough dabs,	1	9	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 6th Feb. 1893. 10.35 a.m. to 12.40 p.m.	W. 42·5 E. 44·5	40·4 40·4	40·8 27½ fath. 40·6 24 fath.	Surface Tow-net. — Euphausidæ, f.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, r.; *Sagitta*, sp. f.; Ctenophora, f. Bottom Tow-net. — Euphausidæ, f.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. c.	Grey skate, Thornback ray, Plaice, Common dabs, Witch soles, Long rough dabs, ,, Haddocks, Cod, ,, Whitings, Anglers,	1 1 1 1 2 1 12 1 1 1 1 1	12 10 18 8 19 12 5–6 13 19½ 6 17½ 22	... ... 2 1 1 10 1 33 2 ... 2 1	... ... 14 7 13 9–10 2½ 5–6½ 18 ... 5½ 14	... ... 1 ... 1 4–9 ... ... 1	... ... 3 ... 10 7–8 ... ... 16	*Nephrops norvegicus*, f.; *Asterias rubens*, f.	At beginning—Wind S., force 1; weather, hazy; sea, slight easterly swell; tide, 4½ hours ebb; barometer, 30·10; transparency, 4 fathoms. At finish—Wind S.W., force 2; weather, hazy; sea, slight easterly swell; tide, ½ hour flood; barometer, 30·10; transparency, 5 fathoms.
Station VI. 20th Jan. 1893. 11.30 a.m. to 12.40 p.m.	W. 42·0 E. 43·0	39·7 40·1	40·6 15½ fath. 41·0 15 fath.	Surface Tow-net.—*Calanus finmarchicus*, r.; *Caligus rapax*, r.; scarcely anything in net Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Sagitta*, sp. c.; Ctenophora, fr.	Plaice, ,, Lemon soles, Common dabs, Long rough dabs, Brill, Haddock, Cod, ,, Whiting, Angler,	3 12 14 2 1 1 1 1 1 1 1	17 13 15 9 8 21 16 38 13 9 47	25 ... 3 ... ... 1	15½ ... 14 ... ... 30	22 ... 1 ... ... 1	14 ... 12 ... ... 21	*Fusus antiquus*, r.; *Asterias*, sp. f.; *Solaster papposa*, *S. endeca*, f.; a few Zoophytes.	At beginning — Wind W. by N., force 6; weather, moderately clear; sea, rough; tide, 4 hours flood; barometer, 30·02; transparency, 3 fathoms. At finish—Wind N.W. by W., force 6; weather and sea as before; tide, 2 hours flood; barometer, 29·02; transparency, 2½ fathoms.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind Weather, and other Observations.
Station VII. 25th Jan. 1893. 11.25 a.m. to 1.10 p.m.	W. 48·5	39·7	40·1 12 fath.	Surface Tow-net.—Hyperiidæ, f.; (*Euthemisto? Parathemisto? Hyperoche*) *Calanus finmarchicus*, f.; Ctenophora, fr.	Starry ray,	1	10½	...	...	...	...	*Asterias*, sp. f.; *Solaster endeca*, f.; *Echinus esculentus*, r.; *Alcyonium*, sp. r.; some Zoophytes (Hydroid).	At beginning—Wind W.S.W., force 3; weather, slight haze; sea, slight; tide 4 hours ebb; barometer, 29·94; transparency, 2 fathoms. At finish—Wind W., force 2; weather and sea as before; tide, 5¾ hours ebb; barometer, 29·96; transparency, 2½ fathoms.
					Plaice,	3	12–12½	...	...	...	...		
					Lemon soles,	1	13	...	...	...	...		
					Common dabs,	1	8	1	6	1	5		
					Flounder,	1	8	...	...	...	...		
	E. 47·0	39·7	39·9 19 fath.	Bottom Tow-net.—Euphausidæ, fr.; *Macropsis slabberi*, fr.; *Mysis flexuosus*, f.; *Mysis*, sp. f.; *Parathemisto*, sp. f.; *Atylus*, sp. f.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. c.; *Tomopteris*, sp. f.; Ctenophora, f.	Long rough dabs,	4	10	12	9	18	8		
					,, ,,	5	6	...	...	...	...		
					Turbot,	1	13½	...	...	...	...		
					Haddocks,	2	9	47	5–7	...	...		
					Cod,	1	8	...	...	...	...		
					Whitings,	1	6	1	5	...	...		
Station VIII. 25th Jan. 1893. 2.15 p.m. to 4.20 p.m.	N.E. 44·0	40·6	41·0 27 fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. fr.; Ctenophora, fr.	Plaice,	1	16	1	14½	...	...	*Fusus antiquus*, r.; *Eupagurus bernhardus*, r.; *Nephrops norvegicus*, r.; *Asterias*, sp. r.; *Solaster papposa*, r.	At beginning—Wind W., force 4; weather, slight haze; sea, slight; tide, about ¾ hours flood, barometer, 29·97; transparency, 5½ fathoms. At finish—Wind W.S.W.; force 2; weather and sea as before; tide, 2¾ hours flood; barometer, 29·92; transparency, 4½ fathoms.
					Lemon soles,	1	8	...	...	...	..		
					Common dabs,	1	12	4	8	2	7		
					,,	1	6	...	...	...	...		
	S.W. 42·0	40·4	41·0 23 fath.	Bottom Tow-net.—Euphausidæ, f.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. fr.	Witch soles,	1	18	1	17	1	14		
					Long rough dabs,	2	9	17	7	10	6		
					,, ,,	3	5	...	...	...	...		
					Haddocks,	1	10	8¼	5–7	...	...		
					Cod,	1	22	1	19	1	16		
					,,	1	15	...	...	...	...		
					Whitings,	3	7	1	4½	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IX. 18th Jan. 1893. 1.0 p.m. to 3.0 p.m.	N.W. 45·0	40·6	41·9 29 fath.	Surface Tow-net.—*Mysis*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, f.; fish ova (plaice), f.	Grey skate,	1	10	...	...	...	...	*Lithodes maia*, one; *Nephrops norvegicus*, f.; *Asterias*, sp. f.; *Aurelia aurita*, f.; some weed.	At beginning — Wind W., force 2; weather, hazy; sea, slight; tide, 4¼ hours flood; barometer, 29·75; transparency, 6 fathoms. At finish—Wind W., force 3; weather and sea as before; tide, ¼ hour ebb; barometer, 29·75; transparency, 7 fathoms.
					Thornback rays,	2	18½	1	12½	1	11½		
					Starry ray,	1	11	...	...	...	...		
					Common dabs,	1	10	3	9	4	8		
					,, ,,	6	6	...	...	...	...		
				Bottom Tow-net.—Euphausidæ, f.; *Hyperoche*, sp. f.; *Calanus finmarchicus*, fr.; *Caligus rapax*, f.; *Sagitta*, sp. fr.; *Tomopteris*. sp. f.	Long rough dabs,	3	10–12	20	8–9	15	7		
	S.E. 46·0	41·0	41·7 33 fath.		,, ,,	7	6	...	...	...	...		
					Haddocks,	1	16	1	13	2	10		
					,, ,,	131	5½–7	...	...	...	...		
					Cod,	1	21	1	19	1	18		
					Whitings,	1	8	...	...	...	...		
					Hake,	1	12	...	...	...	...		
Station X. (Limekilns Stations). 21st Jan. 1893. 11.25 a.m. to 12.30 p.m.	E. 41·5	37·0	37·7 7 fath.	Surface Tow-net. — *Macropsis slabberi*, c.; *Idotea marina* (one specimen); *Calanus finmarchicus*, f.	Thornback rays,	3	8	3	5½	...	...	*Hyas araneus*, f.; *Pandalus annulicornis*, f.; a large quantity of hardened mud composed of masses of *Sabellæ* tubes.	At beginning — Wind N.W., force 1; weather, hazy; sea, smooth; tide, low water; barometer, 30·25; transparency, ⅔ fathoms. At finish—Wind, weather and sea as before; tide, 1 hour flood; barometer, 30·25; transparency, ½ fathom.
					Plaice,	1	11	....	...	..	...		
					Lemon soles,	1	11	...	...	...	...		
					Common dabs,	1	8	1	4	...	...		
					Long rough dabs,	1	9	2	8	2	6		
	W. 40·0	36·6	37·2 7 fath.	Bottom Tow-net. — *Pandalus annulicornis*, f.; *Crangon vulgaris*, r.; *Macropsis slabberi*, fr.; *Mysis vulgaris*, f.; *Mysis lamornæ*, r.; *Mysis*, sp. f.; *Atylus*, sp. f.; *Calanus finmarchicus*, fr.	Cod,	1	30	1	25	1	16		
					,,	7	6–8	...	...	...	...		
					Whitings,	1	9	10	6	3	5		
					Father-lasher,	3	11	1	6	...	...		
					Liparis, sp.,	3	6	6	4½	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
(Liston Bank). 19th Jan. 1893 8.25 a.m. to 10.25 p.m.	W. 43·5	41·0	41·3 25 fath.	Surface Tow-net. — *Sagitta*, sp. f.; scarcely anything in net. Bottom Tow-net.— *Spirialis retroversis?* r.; *Calanus finmarchicus*, fr.; *Caligus*, sp. f.; *Anceus*, r.; *Sagitta*, sp. f.	Starry ray,	1	3	3	11	...	...	*Pecten opercularis*, r.; *Mytilus modiolus*, f.; *Buccinum undatum*, r.; *Fusus antiquus*, r.; Nudibranchs (*Eolis, Dendronotus*), f.; *Hyas coarctatus*, fr. (mostly young); *Asterias*, sp. f.; *Echinus esculentus*, fr. (half grown); Zoophytes, fr.	At beginning—Wind W. by S., force 4; weather, cloudy; sea, moderate; tide, 5¾ hour ebb; barometer, 30·12; transparency, 10 fathoms. At finish — Wind W.S.W., force 5; weather, cloudy, slight haze; sea, choppy; tide, fully 1½ hours flood; barometer, 30·11; transparency, 10 fathoms.
	E. 46·0	41·0	41·5 21½ fath.		Plaice,	1	17	1	16	3	14		
					,,	1	12½	...	...	...	...		
					Lemon sole,	1	14½	...	...	...	...		
					Common dabs,	3	8	5	7	1	5		
					Long rough dab,	1	9	...	...	...	...		
					Haddocks,	1	13	1	10	107	5½–7		
					Cod,	1	6	...	...	...	...		
					Whiting,	1	13	...	...	...	...		
					Gurnard,	1	5	...	...	...	...		
Station I. 21st Feb. 1893. 2.15 p.m. to 4.20 p.m.	E. 40·1	40·2	40·4 14½ fath.	Surface Tow-net. — *Acartia longiremis*, f.; *Sagitta*, sp. f.; Ctenophora, f. Bottom Tow-net. — Euphausidæ, f.; *Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, f.; *Alteutha depressa*, fr.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Tomopteris*, sp. f.	Thornback rays,	2	14	1	12	1	10	*Pecten opercularis*, f.; *Mytilus modiolus*, f.; *Asterias*, sp. fr.; *Astropecten irregularis*, r.; *Ophiothrix rosula*, f.; *Solaster papposa*, f.; *Echinus esculentus*, c.; *Alcyonium*, sp. fr.	At beginning — Wind E.N.E., force 4; weather, hazy; sea, slight easterly swell; tide, 2½ hours flood; barometer, 29·05; transparency, 3½ fathoms. At finish — Wind E., force 4; weather and sea as before; tide, 4½ hours flood; barometer, 29·06; transparency, 2 fathoms.
					,, ,,	1	8	...	...	...	...		
					Plaice,	1	15	3	12	...	...		
					Lemon soles,	3	15	3	13	3	11		
	W. 40·4	41·1	40·6 14 fath.		,, ,,	3	7–8	...	...	...	...		
					Common dabs,	1	11	2	7	2	6		
					Long rough dabs,	1	11	6	10	8	8		
					,, ,,	2	6	...	...	...	...		
					Cod,	1	22	5	17–19	3	15		
					,,	19	5–9	...	...	...	...		
					Whitings,	2	6	1	5	1	4		
					Catfish,	2	35	5	30	1	27		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station II. 21st Feb. 1893. 11.40 a.m. to 3.50 p.m.	W. 41·3	40·1	40·4 12¾ fath.	Surface Tow-net. — *Calanus finmarchicus*, f.; Ctenophora, f. Bottom Tow-net. — Apparently nothing except some fine mud partly in suspension in the water.	Plaice, . .	1	17	2	14	2	12	*Asterias*, sp. fr.; *Solaster papposa*, f.; *Ophiothrix rosula*, f.; *Actinoloba*, sp.; sponges and weed, fr.	At beginning—Wind E., force 2; weather, hazy; sea, slight easterly swell; tide, low water; barometer, 29·32; transparency, 3 fathoms. At finish—Wind E., force 3; weather, hazy, with rain; sea as before; tide, about 2 hours flood; barometer, 29·05; transparency, 3 fathoms.
	E. 39·9	39·9	40·4 14⅓ fath.		Lemon soles, .	1	9	...	...	...	...		
					Common dabs, .	1	12	3	10	3	9		
					,, ,, .	3	6–7	...	...	...	...		
					Flounders, . .	1	12	1	6	...	...		
					Long rough dabs,	1	10	4	9	1	8		
					,, ,, .	1	7	...	...	...	...		
Station III. 20th Feb. 1893. 12.40 p.m. to 3.0 p.m.	E. 47·1	40·2	40·6 8½ fath.	Surface Tow-net. — Euphausidæ, r.; *Parathemisto*, sp. f.; *Idotea marina*, r.; *Acartia longiremis*, f.; Ctenophora, fr.	Grey skate, .	1	14	...	...	...	...	*Pecten opercularis*, fr.; *Fusus antiquus*, r.; *Nephrops*, sp. f.; *Asterias*, sp. fr.; *Solaster papposa*, f.; *Echinus esculentus*, f.; *Actinoloba*, sp.; *Alcyonium*, sp. f.	At beginning — Wind calm; weather, slight haze; sea, smooth; tide, 1½ hours flood; barometer, 29·41; transparency, 2 fathoms. At finish—Wind S.W., force 2; weather, cloudy; sea, slight; tide, 4 hours flood; barometer, 29·35; transparency, 2¾ fathoms.
					Thornback rays, .	1	20	1	14	...	...		
					Plaice, . .	1	14	...	...	...	...		
					Lemon soles, .	4	14	12	12	3	11		
					,, ,, .	4	7–8	...	...	...	...		
	W. 43·8	40·2	40·4 11 fath.	Bottom Tow-net.—Euphausidæ, f.; *Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, f.; *Acartia longiremis*, f.; *Temora longicornis*, f.; *Alteutha depressa*, fr.; *Sagitta*, sp. f.; *Tomopteris*, sp. r.	Common dabs, .	4	9	1	8	1	5		
					Long rough dabs,	2	11	6	9	3	8		
					,, ,, .	9	6	...	...	...	...		
					Haddocks, . .	2	6	...	...	...	...		
					Cod, . . .	1	30	5	24–26	9	18–20		
					,, . . .	4	16	4	12–13	10	9		
					,, . . .	14	7	4	6	...	...		
					Whitings, . .	2	9	3	8	4	7		
					,, . .	2	6	...	...	...	...		
					Anglers, . .	1	23	1	15	...	...		
					Catfish, . .	1	34	1	30	...	...		
					Herrings, . .	2	9	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 17th Feb. 1893. 11.0 a.m. to 1.50 p.m.	E. 40·6	39·7	40·1 8¼ fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, f.	Plaice,	4	14–15	96	12–13	115	10–11	*Pecten opercularis*, f.; *Mytilus modiolus*, f.; *Fusus antiquus*, r.; *Hyas araneus*, f.; *Carcinus mœnus*, r.; *Portunus*, sp. r.; *Asterias*, sp. f.; *Solaster papposa*, r.; *Alcyonium*, sp. f.; Spongozoa, fr.	At beginning—Wind W.S.W., force 4; weather, clear; sea, easterly swell; tide, 2½ hours flood; barometer, 29·72; transparency, 2½ fathoms.
					,,	8	6–9	...	...	...	...		
					Common dabs,	1	13	2	9–10	4	7		
					,, ,,	2	5–6	...	...	...	...		
	W. 43·5	39·5	39·9 6 fath.	Bottom Tow-net.—*Calanus finmarchicus*, c.; *Sagitta*, sp. fr.	Long rough dabs,	1	9	...	...	...	...		
					Cod,	2	29	1	21	...	...		
					Whitings,	1	9	1	6	...	...		At finish—Wind W. by S., force 4; weather, cloudy; sea, slight; tide, 5 hours flood; barometer, 29·73; transparency, 2 fathoms.
Station V. 2nd Mar. 1893. 1.15 p.m. to 3.20 p.m.	E. 41·7	39·5	40·2 24½ fath.	Surface Tow-net.—Very little in net.	Plaice,	1	13	1	8	1	7		
					Lemon soles,	1	10	...	...	...	...		
				Bottom Tow-net.—*Crangon*, sp. r.; *Boreophausia*, sp. fr.; *Mysis*, sp. r.; *Erythrops goesii*, fr.; *Sirella crassipes*, r.; *Diastylus*, sp. f.; *Monoculodes longimanus*, *Amphilochoides*, and other Amphipods, sp. f.; *Calanus finmarchicus*, f.; *Altenutha depressa*, f.; *Sagitta*, sp. fr.; *Tomopteris*, sp. r.; young starfish, f.	Common dabs,	1	9	1	6	1	5		At beginning—Wind N.N.E., force 1; weather, hazy; sea, north-easterly swell; tide, 4½ hours flood; barometer, 29·83; transparency, 3 fathoms.
					,, ,,	1	3½	...	...	...	...		
	W. 41·5	39·7	40·4 29½ fath.		Flounders,	1	16	...	...	...	...		
					Witch soles,	1	19	2	18	1	17		
					,, ,,	3	8–13	...	...	...	...		
					Long rough dabs,	2	10	33	9	38	7		
					,, ,,	15	5–6	...	...	...	...		
					Haddocks,	1	18	3	14	4	11		
					,,	15	5–6	...	...	...	...		At finish—Wind, weather and sea as before; tide, 1 hour ebb; barometer, 29·90; transparency, 3½ fathoms.
					Cod,	4	27	7	21–22	8	14–18		
					,,	2	3½–5	...	...	...	...		
					Whitings,	1	10	2	8	31	4–6		
					Anglers,	1	24	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl net.	Wind, Weather, and other Observations.
Station VI. 2nd March 1893. 4.5 p.m. to 5.5 p.m.	W. 41·5	37·7	40·1 17 fath. 40·1 21½ fath.	Surface Tow-net.—	Plaice, ,, Lemon dabs, Common dabs, ,, ,, Flounders, Long rough dabs, Brill, Halibut, Haddocks, Cod, ,, Whitings, Herring,	1 14 1 1 3 1 1 1 1 1 4 1 1 1	21 12 14 10 6–7 10 6 20 20 10 23 7 9 10	2 ... 2 1 ... ... 2 ... 2 4	17 ... 13 9 ... ... 18 ... 6 22	50 ... 1 3 ... ... 3	14–16 ... 11 8 ... ... 17		At beginning — Wind N.N.E., force 1; weather, clear; sea, slight easterly swell; tide, 1½ hours ebb; barometer, 29·91; transparency, 2½ fathoms. At finish—Wind, weather and sea as before; tide, 2½ hours ebb; barometer, 29·94; transparency, 3 fathoms.
Station VII. 28th Feb. 1893. 10.20 a.m. to 11.50 a.m.	W. 39·3 E. 40·2	38·3 38·8	39·0 12 fath. 38·8 18 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, f.; *Sagitta*, sp. f.	Starry ray, Sandy ray, Plaice, Haddocks, ,, Cod, Whiting, Herring,	1 1 1 1 6 1 1 1	10 8 11 14 5–7 23 5 10	... ... 2 ... 1	... ... 11 ... 18	... ... 2	... ... 10	A few *Asterias*, sp.; and a small quantity of Zoophites and weeds.	At beginning—Wind W.S.W., force 4; weather, hazy; sea, slight; tide, 2½ hours flood; barometer, 29·60; transparency, 1½ fathoms. At finish — Wind and weather as before; sea, choppy; tide, 4 hours flood; barometer, 29·60; transparency, 2 fathoms.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VIII. 24th Feb. 1893. 2.55 p.m. to 2.0 p.m.	S.W. 41·0	39·9	40·6 19¾ fath.	Surface Tow-net.—*Sagitta*, sp. f.; Ctenophora, f.	Grey skate,	1	27	...	...	...	...	*Asterias*, sp. f.; *Solaster endeca*, r.; *Alcyonium*, sp. f.; *Actinia*, sp. f.	At beginning—Wind variable, light; weather, slight haze; sea, slight; tide, 4½ hours ebb; barometer, 29·32; transparency, 3½ fathoms. At finish—Wind, weather and sea as before; tide, near low water; barometer, 29·30; transparency, 4 fathoms.
	N.E. 39·2	40·4	40·8 26½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. fr.	Thornback ray,	1	11	...	...	...	...		
					Plaice,	1	14	...	...	...	...		
					Lemon soles,	1	15	1	12	...	...		
					Common dabs,	1	6	...	...	...	...		
					Long rough dabs,	1	9	2	8	2	6		
					Haddocks,	1	17	1	11	4	5		
					Cod,	1	18	1	17	1	14		
					,,	1	7	...	...	...	...		
					Whitings,	1	7	2	6	...	...		
					Brassie,	1	9	1	8	...	...		
Station IX. 24th Feb. 1893. 3.30 p.m. to 5.35 p.m.	N.W. 39·5	40·1	41·0 28½ fath.	Surface Tow-net.—*Calanus finmarchicus*, r.; *Sagitta*, sp. f.; Ctenophora, f.	Grey skate,	1	18	..	...	...	...	A quantity of *Nephrops*, sp.	At beginning—Wind S., force 1; weather, moderately clear; sea, slight; tide, 1½ hours flood; barometer, 29·30; transparency, 4½ fathoms. At finish—Wind E.S.E., force 1; weather, slight haze; sea, slight easterly sea; tide, 3½ hours flood; barometer, 29·28; transparency, 5 fathoms.
	S.E. 36·3	40·4	41·0 35½ fath.	Bottom Tow-net.—*Erythrops*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.	Plaice,	1	7	...	...	...	...		
					Common dabs,	1	13	8	9–10	22	6–7		
					,, ,,	1	5	...	...	...	...		
					Long rough dabs,	1	11	10	10	35	8–9		
					,, ,,	76	6–7	...	...	...	...		
					Turbot,	1	24	1	23	...	...		
					Haddocks,	2	19	5	17	10	10–13		
					,,	113	5–7	...	...	...	...		
					Cod, ,,	1	31	2	7	...	...		
					Whitings,	2	14–15	1	7	3	6		
					,,	4	5	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.											
	Dry Bulb.	Surface.	Bottom.			No.	Inches	No.	Inches	No.	Inches		
Station X. (Limekilns Station). 23rd Feb. 1893. 11.30 p.m. to 12.25 p.m.	W. 36·3	39·5	40·1 7½ fath.	Surface Tow-net.—*Calanus finmarchicus*, r.; fine mud in suspension in the water. Bottom Tow-net.—*Pandalus annulicornis*, r.; *Crangon vulgaris*, r.; *Mysis*, sp. fr.; *Macropsis slabberi*, fr.; *Gasterosteus spinifer*, f.; *Diastylus*, sp. r.; *Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, c.; *Acartia longiremis*, f.; *Temora longicornis*, f.; *Alteutha*, sp. r.; *Caligus rapax*, f.; *Sagitta*, f.; fine mud in suspension in the water.	Plaice, . .	1	12	...	...	...	...	*Hyas araneus*, f.; *Carcinus mænus*, r.; *Eupagarus bernhardus*, f.; *Asterias*, sp. f.; *Actinozoa*, sp. r; a quantity of hardened mud.	At beginning — Wind E.S., force 2; weather, hazy; sea, slight; tide, 4½ hours ebb; barometer, 29·57; transparency, 4 fathoms. At finish—Wind as before; weather cloudy; sea, as before; tide, 5½ hours ebb; barometer, 29·57; transparency, 3 fathoms.
					Cod, . .	1	10	1	5	...	...		
					Whitings, . .	3	6	...	...	...	...		
	E. 36·5	39·9	40·2 10½ fath.		Sprats, . .	1	4	...	...	...	...		
Station I. 20th April 1893. 10.40 a.m. to 12.45 p.m.	W. 48·2	44·0	43·8 17½ fath.	Surface Tow-net.—Boreophausidæ, f.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Acartia*, sp. f.; *Evadne nordmanni*, r.; *Centropages*, sp. f.; larval Crustacea (*Balani* and others), ab.; fish ova, f.; young fish, fr.	Grey skate, .	1	18	...	...	...	...	*Pecten opercularis*, r; *Mytilus modiolus*, fr.; *Asterias*, fr.; *Solaster papposa*, f.; *Alcyonium*, sp. f.; *Actinoloba*, sp. r.	At beginning — Wind light and weather, hazy; sea, smooth; tide, 5¾ hours ebb; barometer, 30·0; transparency, 2½ fathoms. At finish—Wind E.S.E., force 1; weather, hazy; sea slight; tide, 1¾ hours flood; baro-
					Thornback ray, .	1	22	...	...	...	...		
					Plaice, . .	1	13	11	12	2	10		
					Lemon soles, .	7	13–14	10	12	10	10		
					,, ,, .	9	8–9	...	...	...	...		
					Common dabs, .	2	11	3	10	18	8–9		
					,, ,, .	25	6–7	...	...	...	...		
					Flounders, . .	2	9	1	8	...	...		
	E. 48·2	43·8	43·0 14½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Centropages*, sp. f.; *Sagitta*, fr.; larval	Long rough dabs,	5	10	2	9	5	8		
					,, ,, .	2	7	...	...	...	...		
					Haddocks, .	9	6–7	...	...	...	...		
					Cod, . . .	6	17-18	1	15	2	9		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather and other Observations.
Station I. 20th April 1893. 10.40 a.m. to 12.45 p.m. —*continued.*				*Balani*, c.; Medusidæ (small), f.; young Decapods, fr.; young Gastropods, f.; young starfish, f.	Cod,	4	8	..	...	...	...		meter, 30·0; transparency, 3½ fathoms.
					Whitings,	1	10	3	5	...	...		
					Gurnards,	1	15	4	13	5	12		
					,,	6	9–10	...	...	...	...		
					Anglers,	1	29	1	27	1	23		
					,,	2	15–18	...	...	...	...		
Station II.	W. 48·7	44·1	43·1 14½ fath.	Surface Tow-net.—	Starry ray,	1	11	...	...	...	...	*Mytilus modiolus*, r.; *Buccinum undatum*, r.; *Asterias*, sp. f.; *Solaster papposa*, fr.; *Solaster endeca*, f.; *Ophiothrix rosula*, f.; *Echinus esculentus*, fr.; *Alcyonium*, sp.; *Actinoloba*, sp. fr.; Sponge(?*Hymeniacidon*), f	At beginning — Wind E.N.E., force 3; weather, hazy; sea, slight; tide 4¾ hours flood; barometer, 29·87; transparency, 3½ fathoms. At finish—Wind E.S.E., force 3; weather and sea as before; tide, ½ hour ebb; barometer, 29·86; transparency, 4 fathoms.
19th April 1893. 2.55 p.m. to 4.30 p.m.	E. 50·0	43·8	42·0 14 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Anomalocera pattersoni*, r.; *Sagitta*, sp. fr.; young (larval) *Balani*, f.; some gelatinous algæ.	Plaice,	1	23	9	12–13	3	11		
					,,	3	8–9	...	...	...	...		
					Lemon soles,	1	15	3	13	2	11		
					,, ,,	3	8–9	...	...	...	...		
					Common dabs,	4	9	4	8	6	7		
					,, ,,	2	6	...	...	...	...		
					Flounders,	1	10	1	8	...	..		
					Long rough dabs,	1	8	1	7	...	...		
					Haddocks,	2	6	...	...	...	...		
					Cod,	1	23	1	19	1	16		
					Gurnards,	2	13	7	11–12	15	8–9		
					,,	1	5	...	...	...	...		
					Anglers,	1	35	...	...	..	...		
					Catfish,	3	29	2	21	...	...		
Station III. 19th April 1893. 11.25 a.m. to 2.0 p.m.	E. 50·0	45·2	42·2 8 fath.		Thornback ray,	1	26	...	...	...	...	*Pecten opercularis*, fr.; *Mytilus modiolus*, f.; *Fusus antiquus*, f.; *Hyas araneus*, f.; *Asterias*, sp.	At beginning — Wind E., force 2; weather, hazy; sea, slight; tide, 1½ hours flood; barometer, 29·92; transparency, 3 fathoms.
					Starry ray,	2	12	...	...	...	...		
					Plaice,	4	13	23	12	22	10		
					,,	1	9	...	...	...	...		
	W. 51·8	44·5	43·1 9 fath.		Lemon soles,	2	14	11	13	11	11		
					,, ,,	13	8–9	...	...	...	..		
					Common dabs,	1	11	3	10	7	9		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind Weather, and other Observations.
Station III. 19th April 1893. 11.25 a.m. to 2.0 p.m. —*continued.*					Common dabs,	46	6–8	...	...	...	...	f.; *Ophiothrix rosula, Solaster papposa*, f.; *Echinum esculentus*, fr.; *Alcyonium*, sp. fr.	At finish—Wind E.N.E., force 2; weather and sea as before; tide, 3¾ hours flood; barometer, 29·90; transparency, 3¾ fathoms.
					Flounders,	1	11	1	7	...	...		
					Long rough dabs,	1	11	6	10	9	9		
					,, ,,	9	7–8	...	...	...	...		
					Haddocks,	1	13	18	11	126	5½–8		
					Cod,	1	22	2	16–18	2	15		
					,,	22	6–10	...	...	...	...		
					Whitings,	1	10	1	9	3	7		
					,,	4	6	...	...	...	...		
					Gurnards,	5	12	4	10	1	9		
					,,	1	5	...	...	...	...		
					Anglers,	1	13	...	...	...	...		
					Catfish,	1	36	2	32	1	26		
					Herrings,	5	4½	...	...	...	...		
					Sprats,	2	4	1	3	...	...		
					Lumpsucker,	1	17	...	...	...	...		
Station IV. 20th April 1893. 1.35 p.m. to 4.20 p.m.	E. 55·4	43·8	44·7 8½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Parathemisto*, sp. r.; *Acartia longiremis*, f.; larval *Balani*, ab.; fine mud, c.	Thornback rays,	1	24	1	20	5	18	*Pecten opercularis*, c.; *Mytilus modiolus*, f.; *Fusus antiquus*, f.; *Hyas araneus*, fr.; *Portunus depurator* and *holsatus*, fr.; *Asterias*, sp. f.; *Solaster papposa*, f.; *Chalina*, sp. ab.; *Hymeniacidon*, f.	At beginning—Wind E.S.E., force 1; weather, hazy; sea, smooth; tide, 2½ hours flood; barometer, 30·0; transparency, 2½ fathoms. At finish—Wind light, force 0; weather, hazy; sea, smooth; tide, 5¼ hours flood; barometer, 29·99; transparency, 2 fathoms.
					,, ,,	7	13–16	...	...	...	...		
					Plaice,	1	19	55	12–14	79	10–11		
					,,	40	6–8	...	...	...	...		
	W. 58·4	46·9	45·0 6 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, f.; *Acartia*, sp. f.; *Caligus*, sp. r.; *Sagitta*, sp. f.; *Nerine*, sp. r.; young *Balani*, fr.; young starfishes, young Lamellibranchs, f.; young fish, r.	Lemon soles,	1	13	2	11	1	8		
					Common dabs,	4	11	7	10	8	8		
					,, ,,	43	5–7	...	...	...	...		
					Flounders,	1	12	1	9	2	8		
					Long rough dabs,	1	9	...	...	...	...		
					Whitings,	1	8	1	6	...	...		
					Gurnards,	2	12	9	10	3	8		
					,,	3	6	...	...	...	...		
					Anglers,	1	24	1	20	1	14		
					Herrings,	6	6	...	...	...	...		
					Sprat,	1	3½	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 18th April 1893. 1.0 p.m. to 3.5 p.m.	E. 49·1	42·2	42·0 23 fath.		Plaice,	1	17	3	15	2	12	*Tritonia hombergi*, r.; *Cancer pagurus*, r.; *Nephrops norvegicus*, r.; *Asterias*, sp. fr.; *Solaster papposa*, r.; *Echinus esculentus*, f.	At beginning — Wind, calm; weather, hazy; sea, south easterly swell; tide, 3½ hours flood; barometer, 29·93; transparency, 3½ fathoms. At finish—Wind, weather and sea as before; tide, 5½ hours flood; barometer, 29·91; transparency, 4 fathoms.
					Lemon soles,	1	13	..	...	...	...		
					Common dabs,	1	9	4	7	1	6		
					,, ,,	1	4	...	...	...	...		
					Long rough dabs,	3	10	13	8	9	7		
	W. 48·5	42·7	42·3 29½ fath.		,, ,,	4	6	...	...	...	...		
					Haddocks,	1	12	1	10	21	5½–6		
					Cod,	1	35	4	19–21	3	14		
					,,	2	5½	...	...	...	...		
					Whitings,	1	9	1	8	5	6		
					,,	1	5	...	...	...	...		
					Gurnards,	1	12	1	9	...	...		
					Catfish,	1	31	...	...	...	...		
Station VI. 18th April 1893. 3.55 p.m. to 4.30 p.m.	W. 47·6	43·2	42·5 16½ fath.		Plaice,	1	19	3	18	3	17	*Fusus antiquus*, r.; *Asterias*, sp. f.; *Solaster endeca*, f.; *Spatangus purpureus*, f.; *Cucumaria* sp. (white), f.	At beginning — Wind, calm; weather, hazy; sea, south easterly swell; tide, high water; barometer, 29·90; transparency, 3½ fathoms. At finish—Wind, weather and sea as before; tide, fully 1 hour ebb; barometer, 29·90; transparency, 3¼ fathoms.
					,,	13	14–15	...	...	...	...		
					Lemon soles,	4	13	2	12	9	9-10		
					,,	2	6–8	...	...	...	...		
	E. 47·6	42·4	42·2 16 fath.		Common dabs,	2	8	3	7	2	6		
					,, ,,	1	5	...	...	...	...		
					Haddocks,	3	7	1	5	...	...		
					Cod,	2	29½	7	25–27	4	20-23		
					,,	16	16–18	2	14	1	11		
					,,	1	8	...	...	...	...		
					Anglers,	1	38	1	20	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued*.

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.				No.	Inches	No.	Inches	No.	Inches		
	Dry Bulb.	Surface	Bottom.										
Station VII. 17th April 1893. 1.15 p.m. to 3.15 p.m.	E. 40·6	43·0	42·9	Surface Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, fr.; *Pseudocalanus elongatus*, f.; *Acartia longiremis*, f.; fish ova, f.; post-larval fish, r; young *Balani*, fr.; *Appendicularia*, f.	Grey skates,	1	23	1	19	1	7	*Eupagurus bernhardus*, f.; *Nephrops norvegicus*, f.; *Asterias*, sp. fr.; *Solaster endeca*, fr.; *Astropecten irregularis*, r.; *Luidia sarsii*, r.; *Alcyonium*, sp. fr.	At beginning—Wind S.E., force 4; weather, dull; sea, strong easterly swell; tide, 4½ hours flood; barometer, 30·17; transparency, 3 fathoms.
			18¾ fath.		Starry rays,	1	11	1	10	2	8		
					Plaice,	3	18–19	6	15–16	19	12–13		
					,,	6	11	...	...	...	...		
					Lemon soles,	2	12–13	4	10–11	4	7–9		
					Common dabs,	15	8–9	37	6–7	2	4		
					Flounders,	1	11	2	10	1	9		
					,,	7	7–8	...	...	...	...		
	W. 43·3	43·1	42·3	Bottom Tow-net.—Boreophausidæ, r.; *Pseudocuma*, sp. r.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, r.; *Pseudocalanus elongatus*, f.; *Sagitta*, sp. c.; post-larval fish, r.	Long rough dabs,	1	9	7	8	14	7		At finish—Wind S.E., force 2; weather and sea as before; tide, ¼ hour ebb; barometer, 30·15; transparency, 2½ fathoms.
			13½ fath.		,, ,,	2	6	...	...	...	...		
					Haddocks,	3	11	1	10	48	5½–7		
					Cod,	1	18	2	16	1	15		
					,,	3	8	...	...	...	...		
					Gurnards,	6	14	22	11–12	23	10		
					,,	10	8	...	...	...	...		
					Herring,	1	10	...	...	...	...		
Station VIII. 14th April 1893. 12.50 p.m. to 3.0 p.m.	S.W. 51·0	43·8	41·3	Surface Tow-net.—*Calanus finmarchicus*, f.; gelatinous algæ, ab.	Starry ray,	1	9	...	...	...	...	*Fusus antiquus*, f.; *Nephrops norvegicus*, f.; *Solaster papposa*, r.; *Solaster endeca*, fr.; *Asterias*, sp. f.; *Actinoloba*, sp.	At beginning—Wind W. by N., force 3; weather, slight haze; sea, slight easterly swell; tide, high water; barometer, 30·11; transparency, 4 fathoms.
			21¼ fath.		Plaice,	1	22	1	7	...	...		
					Lemon soles,	2	12	1	10	...	...		
	N.E. 51·0	44·0	41·0	Bottom Tow-net.—*Diastylus*, sp. f.; *Pseudocuma*, f.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Temora longicornis*, fr.; *Pseudocalanus elongatus* (with ova), fr.; *Caligus*, sp. r.; *Cythere*, sp. (? *villosa*), r.; *Nerine*, sp. r.; young starfish, f.	Common dab	1	15	1	13	2	11		
			28 fath.		,, ,,	16	7–9	22	4–6	...	...		
					Flounders,	1	18	2	11	1	9		
					Long rough dabs	13	8	18	7	6	6		
					Haddocks,	1	9	104	5½–7	...	...		
					Cod,	1	29	1	15	...	...		
					Whitings,	4	9	2	8	1	7		
					Gurnards,	1	18	1	14	13	11–12		
					,,	17	8–9	...	...	...	...		
					Anglers,	1	18	...	...	...	...		At finish—Wind W.N.W., force 3; weather and sea as before; tide, 2 hours ebb; barometer, 30·11; transparency, 5 fathoms.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IX. 14th April 1893. 3.50 p.m. to 6.0 p.m.	N.W. 48·2	44·9	41·3 29 fath.	Surface Tow-net. — *Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Pseudocalanus elongatus*, f.; *Evadne nordmanni*, fr.; larval Crustacea, f.; fish ova, f.	Grey skate .	1	17	...	...	...	...	*Fusus antiquus*, f.; *Buccinum undatum*, fr.; *Tritonia hombergi*, r.; *Lithodes maia*, r.; *Nephrops norvegicus*, f.; *Asterias*, sp. f.; *Actinoloba*, sp. r.	At beginning—Wind W.N.W., force 3; weather, slight haze; sea, slight easterly swell; tide, 3 hours ebb; barometer, 30·10; transparency, 5 fathoms.
					Common dabs, .	1	8	4	7	2	6		
					Long rough dabs,	2	7	...	...	...	...		
					Haddocks, . .	1	11	35	5½–6	...	...		
					Whitings, . .	2	12	1	10	...	...		
	S.E. 47·5	43·9	41·3 32½ fath.	Bottom Tow-net. — Half filled with mud, which, when washed and examined, yielded the following among other rare organisms; *Nœra cuspidata*, *Petalomera declivis*, *Cephalaspis*, sp.; several Amphipods not yet identified, &c.	Gurnards, . .	2	10	1	8	...	...		At finish — Wind W. by N., force 4; weather and sea as before; tide, 5½ hours ebb; barometer, 20·10; transparency, 5 fathoms.
					Anglers, . .	1	31	1	25	1	20		
					,, . .	1	14	...	...	...	...		
Station X. (Limekilns Station). 21st April 1893. 10.55 a.m. to 11.45 a.m.	E. 46·2	46·0	45·7 7½ fath.	Surface Tow-net. — *Macropsis slabberi*, fr.; *Temora longicornis*, f.; *Acartia longiremis*, c.; *Echinosoma atlanticum*, f.; *Alteutha depressa*, fr.; *Sagitta*, sp. f.; young herring or sprats, fr.; fish ova, r.	Grey skates, .	1	17	1	12	1	7	*Hyas araneus*, fr.; *Portunus depurator*, f.; *Eupagurus bernhardus*, f.; *Asterias*, sp. f.; large quantity of mud and worm tubes.	At beginning—Wind E., force 5; weather, cloudy; sea, moderate; tide, 4½ hours ebb; barometer, 29·87; transparency, ½ fathom.
					Thornback rays,	1	25	1	21	1	16		
					,, ,, .	2	15	1	14	1	10		
					,, ,, .	2	8	1	6	...	...		
					Lemon sole, .	1	8	...	...	...	...		
					Whitings, . .	6	6	...	...	...	...		
					Father-lasher, .	1	10	...	...	...	...		
	W. 46·9	46·1	46·0 5 fath.	Bottom Tow-net. — *Mysis ornatus*, f.; *Mysis*, sp. r.; *Diastylus*, sp. f.; *Pseudocuma cercaria*, r.; *Monoculodes longimanus*, r.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Acartia longiremis*, c.; young *Balani*, fr.										At finish—Wind E., force 5; weather and sea as before; tide, 5½ hours ebb; barometer, 29·87; transparency, ¼ fathom.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 27th May 1893. 11.10 a.m. to 1.15 p.m.	E. 58·1	49·4	44·9 15½ fath.	Surface Tow-net. — *Calanus finmarchicus*, f.; *Acartia longiremis*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.; small Medusidæ, fr.; young Crustacea, f.; fish ova, fr.	Thornback ray,	1	25	...	...	...	...	*Pecten operculatis*, f.; *Mytilus modiolus*, f.; *Fusus antiquus*, r.; young cuttle fish, r.; *Buccinum undatum*, f.; *Asterias rubens*, f.; *Echinus esculentus*, fr.; Zoophytes, f.	At beginning — Wind W., force 1; weather, cloudy; sea, smooth; tide, 4¾ hours flood; barometer, 30·18; transparency, 3½ fathoms. At finish—Wind W., force 2; weather, cloudy; sea, slight; tide, ½ hour ebb; barometer, 30·18; transparency, 3 fathoms.
					Plaice,	2	14	13	12	4	10		
					Lemon soles,	1	14	4	11	9	10		
					,, ,,	6	7	...	...	...	...		
					Common dabs,	3	12	6	9	10	7½		
					,, ,,	10	6	...	...	...	...		
	W. 60·8	49·2	45·3 14 fath.	Bottom Tow-net.—Copepoda (*Calanus*, *Temora*, *Centropages*), f.; young Decapods, Crustacea, fr.	Long rough dabs,	2	11	9	8	2	5		
					Haddocks,	2	10	4	6	...	...		
					Cod,	1	31	1	26	1	11		
					,,	3	7	...	...	...	...		
					Whitings,	1	8	2	7	...	...		
					Gurnards,	1	17	13	12–14	10	9		
					,,	18	5–7½	...	...	...	...		
					Anglers,	1	26	2	24	1	20		
					,,	1	14	...	...	...	...		
					Catfish,	1	35	2	36	6	28		
					,,	1	25	...	...	...	...		
Station II. 31st May 1893. 10.30 a.m. to 12.5 p.m.	E. 51·2	50·9	47·3 12 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Sagitta*, sp. f.; small Medusidæ, f.; young Decapod, Crustacea, f.; young fish, r.; fish ova, fr.	Thornback ray,	1	16	...	...	...	...	*Mytilus modiolus*, r.; *Fusus antiquus*, f.; Ascidians, f.; *Asterias rubens*, c.; *Ophiothrix rosula*, f.; *Solaster papposa*, *S. endeca*, fr.; *Alcyonium*, sp. f.	At beginning—Wind W.S.W., force 2; weather, cloudy; sea, north easterly swell; tide, 1¾ hours flood; barometer, 30·03; transparency, 3½ fathoms. At finish—Wind S. by E., force 1; weather and sea as before; tide, 3¼ hours flood; barometer, 30·01; transparency, 3½ fathoms.
					Plaice,	1	16	5	13–14	9	11		
					,,	4	9	...	...	...	...		
					Lemon soles,	3	12	4	10–11	3	9		
					,, ,,	3	7	...	...	...	...		
					Common dabs,	5	8	13	7	16	4½–5		
					Long rough dabs,	2	10	3	8½	1	7		
	W. 53·6	51·9	46·9 13 fath.	Bottom Tow-net. — *Acartia longiremis*, fr.; *Temora longicornis*, fr.; small Medusidæ, f.	Cod,	1	19	1	12	2	9		
					Gurnards,	4	11–12	1	9	8	7½		
					,,	19	5-6	...	...	..	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
Station III. 24th May 1893. 10.20 a.m. to 12.25 p.m.	W. 62·6	50·3	47·4 8½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.; young Crustacea (Decapoda, Schizopoda,) fr.; young fish, fr.; fish ova, fr.	Plaice,	5	14–15	52	12–13	23	10–11	*Pecten opercularis*, f.; *Fusus antiquus*, f.; *Hyas coarctatus*, f.; *Asterias rubens*, fr.; *Actinoloba*, sp. f.	At beginning—Wind W. by N., force 4; weather, cloudy; sea, slight; tide, ¼ hour ebb; barometer, 29·72; transparency, 2½ fathoms.
					,,	2	8	...	...	...	...		
					Lemon soles,	2	13½	6	12	5	10		
					,, ,,	3	7	...	...	...	...		
					Common dabs,	2	11	4	9	11	7½		
					,, ,,	5	5	...	...	...	...		
	E. 61·7	50·2	46·5 13 fath.	Bottom Tow-net.—*Temora longicornis*, r.; *Caligus rapax*, r.; *Sagitta*, sp. f.; Medusidæ, fr.; young *Balani*, f.	Long rough dabs,	8	10	12	7–8	...	...		
					Haddocks,	6	7	...	...	...	...		
					Cod,	4	17–19	3	12½	7	10		At finish—Wind W. by N., force 5; weather, cloudy; sea, moderate; tide, 2¼ hours ebb; barometer, 29·76; transparency, 3 fathoms.
					,,	10	6–8	...	...	...	...		
					Whitings,	2	14	2	11	5	6–8		
					Ling,	1	13	...	...	...	...		
					Gurnards,	2	14	15	11	26	9		
					,,	14	5–6½	...	...	...	...		
					Catfish,	2	32	1	31	1	27		
					,,	1	24	...	...	...	...		
Station IV. 23rd May 1893. 12.25 p.m. to 2.35 p.m.	W. 59·9	50·0	51·5 5 fath.	Surface Tow-net.—*Acartia longiremis*, f.; *Temora longicornis*, r.; *Parathemisto*, sp. r.; small Medusidæ, fr.; young Decapod, Crustacea, f.; fish ova, f.	Thornback ray,	1	20	...	...	...	...	*Pecten opercularis*, ab.; *Mytilus modiolus*, f.; *Buccium undatum*, r.; *Hyas araneus*, f.; *Portunus depurator*, f.; *Solaster papposa*, r.; *Asterias rubens*, f.; *Ophio-*	At beginning—Wind W. by S., force 3; weather, cloudy; sea, slight; tide, 3½ hours ebb; barometer, 29·66; transparency, 2 fathoms.
					Plaice,	23	13–14	40	11–12	30	9–10		
					,,	14	7–8	...	...	...	...		
					Lemon soles,	1	13	2	10½	2	8		
					,,	2	6½	...	...	...	...		
					Common dabs,	3	11½	7	8½–9½	9	7		
					,, ,,	5	4–5	...	...	...	...		
	E. 59·0	51·3	51·4 6½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Acartia longiremis*, f.; *Caligus rapax*, 2; young Annelida, r.	Long rough dabs,	1	8	...	...	...	...		At finish—Wind W., force 3; weather and sea as before; tide, 5½
					Haddocks,	1	6	...	...	...	...		
					Cod,	5	11	7	9	5	7		
					Whitings,	1	10	2	7	2	6		
					Gurnards,	2	14	12	10	16	8		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 23rd May 1893. 12.25 p.m. to 2.35 p.m. —*continued.*					Gurnards, . .	20	5½–7	...	...	...	...	*thrix rosula*, f.; *Chalina occulata*, f.	hours ebb; barometer, 29·69; transparency, 2¼ fathoms.
					Angler, . .	1	7	...	...	...	...		
					Sprat, . .	1	4	...	...	...	...		
					Goby, . .	1	2½	...	...	...	...		
Station V. 30th May 1893. 3.45 p.m. to 5.55 p.m.	W. 50·9	48·5	44·0 28½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; small Medusidæ, ab.; young Decapoda, f.; fish ova, r.	Grey skate, .	1	19	...	...	...	...	Young *Lolligo*, r.; *Cancer pagurus*, r.; *Nephrops norvegicus*, f.; *Asterias rubens*, fr.; *Solaster papposa*, *S. endeca*, r.	At beginning — Wind E., force 1; weather, cloudy; sea, north easterly swell; tide, 1½ hours ebb; barometer, 30·09; transparency, 5 fathoms. At finish—Wind, weather and sea as before; tide, 3¾ hours ebb; barometer, 30·08; transparency, 4 fathoms.
					Plaice, . .	1	18	4	16	13	12–14		
					,, . .	2	9	...	...	...	...		
					Lemon soles, .	1	14	2	10	...	...		
					Common dabs, .	2	7	...	...	...	...		
	E. 50·0	49·3	44·8 22 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, fr.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Alteutha*, sp. f.; *Podon*, sp. f.; *Sagitta*, sp. f.; small Medusidæ, f.; young Gastropods and Lamellibranchs, f.; young *Balani*, f.	Witch soles, .	4	17	2	12	...	...		
					Long rough dabs,	8	10	20	7–8	6	5–6		
					Haddocks, . .	1	17	2	12	77	6–7		
					Cod, . . .	1	28	5	20	4	18		
					,, . .	1	6	...	...	...	...		
					Whitings, . .	1	12	...	...	...	...		
					Gurnards, .	3	13	2	10	9	8		
					Hake, . .	1	40	...	...	...	...		
Station VI. 31st May 1893. 8 5 a.m. to 10 a.m.	E. 47·6	48·8	47·4 14 fath.	Surface Tow-net.—*Calanus finmarchicus*, ab.; *Temora longicornis*, f.; *Anomalocera patterson*, f.; young Decapod and Schizopod Crustacea, ab.; small Medusidæ, c.; young fish, fr.; fish ova, r.	Plaice, . .	2	18	11	15–16	8	13	*Fusus antiquus*, f.; *Asterias rubens*, f.; *Solaster endeca*, fr.; *Solaster papposa*, f.; *Spatangus purpureus*, fr.; *Cu-*	At beginning — Wind N.E.; force 1; weather, overcast; sea, north easterly swell; tide, 5½ hours ebb; barometer, 30·05; transparency, 5 fathoms. At finish — Wind
					,, . .	3	11	...	...	...	...		
					Lemon soles, .	7	14	8	13	3	11		
					,, ,, .	7	9	...	...	...	...		
					Common dabs, .	1	9	2	8	1	7		
					,, ,, .	4	6	...	...	...	...		
					Haddocks, . .	1	11	2	7	...	...		
					Gurnards, . .	1	13	9	11½	46	9–10		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VI. 31st May 1893. 8.5 a.m. to 9.10 a.m. —*continued.*	W. 51	48·0	46·5 11½ fath.	Bottom Tow-net.—Copepoda (*Calanus, Acartia, Temora*), fr.; *Podon*, sp. f.; small Medusidæ, fr.; *Sagitta*, sp. f.; young *Balani* and Annelids, f.	Gurnards, . .	65	6–7	...	...	...	...	*cumaria lactea* (?), f. sp. *Alcyonium*, f.	S.S.E.; force 1; weather, cloudy; sea, north easterly swell; tide, ½ hour flood; barometer, 30·05; transparency, 4¼ fathoms.
					Anglers, . .	1	33	1	29	1	25		
					,, . .	3	15–18	...	...	...	...		
Station VII. 24th May 1893. 1.10 p.m. to 2.45 p.m.	W. 61·5	52·4	46·8 12⅔ fath.	Surface Tow-net.—Boreophausidæ, r.; *Calanus finmarchicus*, f.; *Centropages*, sp. f.; young Decapod Crustacea, f.; fish ova, f.; (a quantity of fine mud suspended in the water).	Plaice, . .	2	17–19	1	14	5	13	*Asterias rubens*, f.; *Solaster endeca*, r.; weed and Zoophytes, f.	At beginning—Wind, W by N., force 5; weather, cloudy fine; sea, slight; tide, 2 hours ebb; barometer, 29·77; transparency, 3½ fathoms. At finish.—Wind W., force 5 weather, as before; sea, moderate; tide, 4¼ hours ebb; barometer, 29·80; transparency, 3½ fathoms.
					,, . .	3	9–11	...	...	...	...		
					Lemon soles, .	1	14	3	11	5	10		
					,, ,, .	2	8	...	...	...	...		
					Common dabs, .	7	8	20	7	21	5–6		
					Long rough dabs,	1	10	2	8	6	6		
	E. 60·4	50·2	48·0 18½ fath.	Bottom Tow-net.—Copepoda (*Calanus, Acartia, Temora, Centropages*), f.; *Caligus rapax*, f.; *Sagitta*, sp. f.; small Annelids with ova (? *Nerine*, f.; *Appendicularia*, f.; young *Balani*, fr.; young fish, f.	Haddocks, . .	8	12	47	6–7	...	...		
					Whitings, . .	1	12	1	10	1	5		
					Gurnards, . .	4	10	23	8–9	20	7		
					,, . .	10	5–6	...	..	...	..		
					Catfish, . .	1	36	...	..	...	...		
Station VIII. 30th May 1893. 12.35 p.m. to 2.35 p.m.	S.W. 50·0	51·0	45·0 21½ fath.	Surface Tow-net—*Parathemisto*, sp. r.; *Anomalocera pattersoni*, fr.; *Sagitta*, sp. f.; young Decapod Crustacea, fr.; fish (young), r.; fish ova, f.	Plaice, . .	1	15	1	13	2	12	*Nephrops norvegicus*, r.; *Asterias rubens*, f.; *Solaster endeca*, f.; *Alcyonium*, sp. f.	At beginning—Wind N.E., light; weather, cloudy; sea, strong north easterly swell; tide, 4½ hours flood; barometer, 30·10; transparency, 4½ fathoms.
					,, . .	1	11	...	...	...	...		
					Lemon soles, .	1	11	1	9	1	7		
					Common dabs, .	1	9	2	8	7	6		
	N.E. 50·1	50·3	43·3 27½ fath.		,, ,, .	7	5	...	..	...	...		
					Witch soles, .	2	17	2	15	2	13		
				Bottom Tow-net.—*Calanus finmarchicus*, f.;	Sail fluke, .	1	20	...	...	...	...		
					Long rough dabs,	3	9	10	7	1	6		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.				No.	Inches	No.	Inches	No.	Inches		
	Dry Bulb.	Surface.	Bottom.										
Station VIII. 30th May 1893. 12.35 p.m. to 2.35 p.m. —*continued.*				*Temora longicornis*, fr.; *Sagitta*, sp. fr.; small Medusidæ?. *Nerine*, sp.; and young Schizopoda, f.; young fish, r.	Haddocks, . .	5	13	1	11	2	8		At finish—Wind E., light; weather, cloudy; sea, strong north easterly swell; tide, ¼ hour ebb; barometer, 30·10; transparency, 6¾ fathoms.
					,, . .	19	6-7	...	..	...	...		
					Cod, . .	1	32	2	18	1	16		
					Whitings, . .	1	10	1	5	...	...		
					Brassie, . .	1	9	...	..	...	...		
					Gurnards, . .	1	15	1	13	4	10		
					,, . .	34	7-8	...	...	...	...		
					Dragonet, . .	1	8	...	...	...	...		
Station IX. 2nd June 1893. 12.10 p.m. to 2.20 p.m.	S.E. 59·0	50·1	43·3 33 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, r.; *Anomalocera pattersoni*, c.; *Sagitta*, f.; Decapod Crustacea, fr.; young fish, r.; fish ova, fr.	Grey skate, .	1	14	...	...	..	...	*Eupagurus bernhardus*—*Nephrops norvegicus*, *Asterias rubens*, *Solaster papposa*—sea anemone.	At beginning—Wind S.E., force 1; weather, slight haze; sea, easterly swell; tide, 2¼ hours flood; barometer, 29·87; transparency, 7½ fathoms. At finish—Wind as before; weather, hazy; sea, as before; tide, 4¼ hours flood; barometer, 29·88; transparency, 7 fathoms.
					Starry ray, .	1	12	...	...	...	...		
					Lemon soles, .	1	13	1	10	...	...		
					Common dabs, .	1	8	1	7	1	6		
					Witch soles, .	1	19	1	10	...	...		
					Long rough dabs, .	2	10	3	9	13	7-8		
					,, ,, .	4	4½-6	...	...	...	...		
	N.W. 57·9	51·9	43·0 31 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Evadne*, sp. f.; *Sagitta*, sp. c.; young *Balani*, f.	Haddocks, . .	1	15	1	12	1	10		
					,, . .	81	5½-8	...	...	...	...		
					Cod, . .	1	12	1	7½	2	6		
					Whitings, . .	1	12	1	11	1	10		
					Gurnards, . .	1	9	1	8	2	4½		
Station X. (Limekilns Station), 29th May 1893. 12.50 p.m. to 1.40 p.m.	E. 49·8	50·0	50·0 9½ fath.	Surface Tow-net.—Copepoda (*Temora*, *Acartia*) fr.; *Caligus*, sp. r.; young Entomostraca and Decapoda, f.; the water dirty with suspended mud.	Grey skate, .	2	7½	1	6½	...	...	*Hyas araneus*, fr.; *Carcinus mœnus*, f.; *Eupagurus bernhardus*, f.; *Portunus holsatus*, r.; *Asterias rubens*, f.; *Actinia*, f.; Polyzoa (*Alcyoni-*	At beginning — Wind E., force 4; weather, overcast; sea, slight; tide, 4¾ hours flood; barometer, 29·13; transparency, 1 fathom.
					Thornback rays, .	1	10	1	9	3	5		
					Plaice, . .	1	9	...	...	...	...		
					Lemon soles, .	1	11	1	9	...	...		
					Cod, . . .	2	10	3	8	1	7		
					,, . . .	2	6	...	...	...	...		
	W. 50·5	50·5	50·0 8 fath.	Bottom tow-net.—*Mysis ornatus*, f.; *Diastylis*, sp.	Whitings, . .	1	10	1	8	1	7		
					,, . .	4	5-6	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Surface Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station X. (Limekilns Station). 29th May 1893. 12.50 p.m. to 1.40 p.m. —*continued.*				r.; *Atylus*, sp. f.; Copepoda (*Calanus, Acartia, Temora, Parapontella*), c.	Pogge, . . Father-lasher, .	1 1	4 7	... ...	... ...	... ...	... ...	*dium*), f.; Hydrozoa, sea anemones — (*Tubularia, Garveia*, &c.), fr.; Annelida (*Nereis, Sabella*), fr.; Spongidæ (*Chalinula*), f.	At finish—Wind, weather and sea as before; tide, 5½ hours flood; barometer, 29·14; transparency, ¾ fathom.
Station I. 15th June 1893. 11.5 a.m. to 1.0 p.m.	E. 57·2	54·0	50·5 14½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, f.; *Anomalocera patterson*i, r.; *Sagitta*, sp. r.; small Medusidæ, fr.; fish ova, f.	Grey skate, . . Thornback ray, . Plaice, . . Lemon soles, . Common dabs, . Long rough dabs,	1 1 5 4 2 5	26 21 13 13 9 8½	... ... 13 16 2 1	... ... 11 10–11½ 8 6½	... ... 2 11 5 ...	... ... 10 7–8 6½ ...	Cuttle fish (young), r.; *Nephrops norvegicus*, f.; *Ophiothrix rosula*, f.; *Echinus esculentus*, c.	At beginning—Wind E., force 2; weather, hazy; sea, easterly swell; tide, 2 hours flood; barometer, 30·05; transparency, 4½ fathoms.
	W. 57·9	56·0	55·3 13½ fath.	Bottom Tow-net.—*Eudorella truncatula*, r.; *Diastylis*, sp. r.; *Hyperoche*, sp. r.; *Acartia longiremis*, fr.; *Temora longicornis*, fr.; *Parapontella brevicornis*, fr.; young *Balani*, fr.; young Decapods, f.	Haddocks, . . Cod, . . . Whitings, . . Gurnards, . . Angler, . . Catfish, . .	48 4 2 2 1 2	6–7½ 13–16 6 12 27 30	... 1 ... 7 ... 1	... 9 ... 10 ... 24	... 14 ... 10	... 6–7 ... 6–8		At finish—Wind E., force 2; weather, fog; sea as before; tide, 4 hours flood; barometer, 30·04; transparency, 2½ fathoms.
Station II. 17th June 1893. 11.20 a.m. to 12.45 p.m.	E. 67·1	56·1	48·3 11½ fath.	Surface Tow-net.—*Temora longicornis*, f.; Infusoria, fr.; mud suspended in the water, ab.	Plaice, . . ,, . . Lemon soles, . ,, . .	1 8 3 5	15 8½ 12 7	18 ... 4 ...	12–13 ... 10 ...	19 ... 7 ...	10 ... 8½ ...	*Fusus antiquus*, r.; *Asterias*, sp. f.; *Ophiothrix rosula*, f.; *Solaster papposa*, r.; *Flustra*, sp.;	At beginning—Wind S.W., force 1; weather, fine; sea, slight; tide ½ hour flood; barometer, 30·27; transparency, 4 fathoms.
	W. 68·0	55·0	50·0 13 fath.	Bottom Tow-net.—*Hyperoche*, sp. r.; *Calanus finmarchicus*, f.; *Acartia*	Common dabs, . Long rough dabs, ,, ,,	1 2 12	10 12 6–7	7 7 ...	8 10 ...	56 3 ...	5½–6½ 8½ ...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.				No.	Inches	No.	Inches	No.	Inches		
	Dry Bulb.	Surface.	Bottom.										
Station II. 17th June 1893. 11.20 a.m. to 12.45 p.m. —*continued.*				*longiremis*, c.; *Centropages*, sp. f.; *Anomalocera pattersoni*, r.; *Sagitta*, f.; young Decapods, f.; *Podon*, sp. fr.; young Annelids, f.; young Ophiuridæ, fr.; young Lamellibranchs, f.	Haddocks, . .	1	11	37	6½–8	...	...	*Alcyonium*, sp.; Sponges.	At finish—Wind S.W., force 1; weather, slight haze, fine: sea, slight; tide, 2 hours flood; barometer, 30·27; transparency, 3 fathoms.
					Cod, . . .	2	9	1	7	...	...		
					Whitings, . .	2	9	1	7	1	5½		
					Gurnards, . .	1	16	2	12–14	1	10		
					,, . .	26	6½–8	...	...	...	...		
Station III. 16th June 1893. 2.35 p.m. to 4.50 p.m.	E. 57·0	55·4	52·8 8½ fath.	Surface Tow-net.—*Hyperoche*, sp. r.; *Temora longicornis*, f.; *Acartia longiremis*, f.; *Anomalocera pattersoni*, r.; young Decapods, f.; Infusoria, c.; a quantity of fine mud suspended in the water.	Plaice, . .	7	14–16	101	11½–13	15	8–9	*Pecten opercularis*, f.; *Buccinum undatum*, r.; *Fusus antiquus*, r.; *Nephrops norvegicus*, f.; *Asterias*, sp. f.; *Eupagurus bernhardus*, f.; *Solaster papposa*, f.; *Ophiothrix*, sp. f.; *Alcyonium*, sp. f.	At beginning—Wind W., force 2; weather, hazy; sea, slight; tide, 4½ hours flood; barometer, 30·90; transparency, 3 fathoms. At finish—Wind W., force 2; weather, hazy; sea, slight tide, ¾ hour ebb; barometer, 30·09; transparency, 3½ fathoms.
	W. 66·2	55·6			Lemon soles, .	5	13	15	10–11	10	8½		
					Common dabs, .	3	10	17	8	15	7–6		
					Long rough dabs,	3	10	3	9	3	7½		
					Haddocks, . .	1	13	1	11	81	6–8		
			50·0 10 fath.	Bottom Tow-net.—*Hyperoche*, sp.; *Calanus finmarchicus*, fr.; *Temora longicornis*, c.; *Sagitta*, sp. fr.; small Medusæ, c.; young Decapods, f.; young *Balani*, ab.; young fish, f.	Cod, . . .	1	19	3	15–17	12	7–10		
					Whitings, . .	6	11–12	3	7	2	5		
					Gurnards, . .	2	13	7	10	6	8		
					Angler, . .	1	36	...	...	...	...		
					Catfish, . .	1	34	...	...	...	...		
					Sprat, . .	1	4½	...	...	...	...		
Station IV. 19th June 1893. 2.45 p.m. to 5.0 p.m.	E. 59·0	58·3	54·4 8 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia*, sp. fr.; Infusoria, fr.	Thornback rays,	1	21	1	22	...	...	*Pecten opercularis*, ab.; *Buccinum*, sp.; r.; Cuttle fish, *Portunus*, sp. fr.;	At beginning—Wind E.S.E., force 6; weather, overcast; sea, choppy; tide, 2¼ hours flood;
					Plaice, . .	10	13	28	11½	12	10		
					,, . .	27	8½	...	...	...	...		
					Lemon soles, .	1	12	5	10	2	8		
				Bottom Tow-net—*Cal-*	Common dabs, .	2	12	5	8–10	7	6–7		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 19th June 1893. 2.45 p.m. to 5.0 p.m. —*continued.*	W. 59·7	58·1	59·7 6 fath.	*anus*, sp. f.; *Temora*, sp. f.; *Acartia*, sp. f.; *Sagitta*, sp. f.; very little in either surface or bottom tow-nets.	Long rough dabs,	1	8	...	...	...	...	*Asterias*, sp .f.; *Ophiothrix rosula*, f.; *Echinus esculentus*, r.; Zoophytes, f.	barometer, 29·97; transparency, 3 fathoms. At finish — Wind E., force 4; weather as before; sea, slight; tide, 4½ hours flood; barometer, 29·96; transparency, 2 fathoms.
					Haddocks,	242	6–7⅓	...	...	...	...		
					Cod,	7	12	6	9–10	5	7		
					,,	4	6	...	...	...	...		
					Whitings,	10	10	26	8	31	5½–6½		
					Gurnards,	3	14	4	11	13	8		
					,,	15	5–6	...	...	...	...		
					Hake,	2	13	...	...	...	...		
					Sprats,	4	4	...	...	...	...		
					Pogge,	1	3	...	...	...	...		
Station V. 13th June 1893. 2.35 p.m. to 4.20 p.m.	W. 54·5	54·8	54·5 30 fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Anomalocera pattersoni*, c.; young Schizopods, f.; young Decapods, ab.; young *Mytilus*, f.; young fish, f.	Grey skate,	1	18	1	16½	...	...	*Fusus antiquus*, r.; *Tritonia hombergi*, r.; *Nephrops norvegicus*, f.	At beginning — Wind E., force 3; weather, hazy; sea, slight easterly swell; tide, 1½ hours ebb; barometer, 30·06; transparency, 5½ fathoms. At finish—Wind S.E., force 5; weather, hazy; sea, choppy; tide, 3 hours ebb; barometer, 30·02; transparency, 5 fathoms.
					Starry ray,	1	9½	...	...	...	...		
					Plaice,	5	18–20	14	13–15	8	10–12		
					Lemon soles,	2	15	1	13	3	10–11		
					Common dabs,	2	9	6	8	5	7		
					Witch soles,	1	17	1	13½	1	12		
	E. 53·6	54·7	53·6 24 fath.	Bottom Tow-net.—*Diastylis*, sp. f.; *Calanus finmarchicus*, fr.; *Temora longicornis*, fr.; *Centropages*, sp. f.; *Sagitta*, sp. c.; young Crustacea, ab.; young fish, f.	Sail fluke,	1	15	...	...	...	...		
					Long rough dabs,	11	10–11	15	8–9	20	6–7		
					Haddocks,	6	12	2	10	57	6½–8		
					Cod,	3	22–24	6	15–18½	3	10–14		
					Whitings,	3	13	2	10	...	...		
					Gurnards,	4	12	1	10	4	9		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VI. 19th June 1893. 12.5 p.m. to 1.10 p.m.	E. 64·4	53·0	49·4 13 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, fr.; *Temora longicornis*, fr.; *Evadne*, sp. fr.; *Podon*, sp. f.; *Sagitta*, sp. f.; young Decapods, fr.; young *Balani*, c.; fish ova, f.	Plaice,	2	22–23½	3	17–20	8	14–16	*Solaster endeca*, f.; *Astropecten irregularis*, f.; *Alcyonium*, sp. f.	At beginning — Wind W.S.W., force 2; weather, cloudy; sea, slight; tide, near low water; barometer, 29·98; transparency, 4½ fathoms.
					,,	5	12–13	...	...	...	...		
					Lemon soles,	2	14–15	5	12–13	1	9		
					,, ,,	1	7	...	...	...	...		
					Common dabs,	4	9–10	15	7	20	5½–6		
	N. 60·8	52·0	49·5 12 fath.	Bottom Tow-net.—Copepoda (*Calanus*, *Acartia*, *Temora*), f.; *Sagitta*, sp. r.; *Appendicularia*, sp. f.; young Lamellibranchs; young starfishes (Ophiuridæ), small Medusæ, f.	Haddocks,	57	6½–8	...	...	...	...		At finish — Wind S.E., force 2; weather and sea as before; tide, ⅔ hour flood; barometer, 29·97; transparency, 3 fathoms.
					Cod,	1	16	2	10	3	7		
					Whitings,	11	11	4	7	22	5½–6		
					Gurnards,	6	10	10	7	12	5		
					Anglers,	1	25½	1	24	...	...		
Station VII. 14th June 1893. 12.50 p.m. to 2.50 p.m.	E. 51·8	49·0	47·0 19¾ fath.	Surface Tow-net dama[illegible]d.	Plaice,	2	16–17	30	12½–14	28	9-10½	*Asterias*, f.; *Solaster papposa*, *S. endeca*, f.; *Luidia sarsii*, r.; *Alcyonium*, fr.	At beginning — Wind S.S.E., force 6; weather, hazy; sea, rough; tide, 5 hours flood; barometer, 29·97; transparency, 4½ fathoms.
					Lemon soles,	3	12½	9	9–10½	4	7		
					Common dabs,	4	8½	65	7	35	5½		
	W. 55·4	51·0	49·0 12 fath.	Bottom Tow-net.—*Acartia longiremis*, f.; *Temora longicornis*, fr.; *Centropages*, sp. f.; *Thalestris longimanus*, r.; *Alteutha*, sp. r.; *Podon*, sp. f.; *Sagitta*, sp. f.; small Medusidæ, c.; young Decapods and *Balani*, f.; young Annelids, f.	Long rough dabs,	13	9	16	17	2	6		
					Haddocks,	1	14	22	10–12	123	6½–7½		
					Cod,	1	20	3	11	...	...		
					Whitings,	4	10	1	6	...	...		
					Gurnards,	1	10	21	9	19	7		
					Anglers,	1	24	1	20	...	...		
					Catfish,	2	29	1	25	...	...		
					Dragonet,	1	9	...	...	...	...		At finish—Wind S., force 6; weather, slight haze; sea, choppy; tide, ¾ hour ebb; barometer, 29·97; transparency, 2½ fathoms.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station. Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate, Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VIII. 14th June 1893. 10.25 a.m. to 12.25 p.m.	N.E. 51·8	50·3	46·5 28 fath.	Surface Tow-net damaged.	Grey skate,	1	20	1	15½	...	...	*Nephrops norvegicus*, f.; *Asterias*, sp. f.; *Solaster papposa*, f.	At beginning — Wind S.E., force 5; weather, hazy; sea, choppy; tide, 2½ hours flood; barometer, 30·01; transparency, 5 fathoms. At finish—Wind S.S.E., force 6; weather, hazy; sea, rough; tide, 4½ hours flood; barometer, 29·99; transparency, 4 fathoms.
					Starry ray,	1	6	...	...	...	...		
					Plaice,	4	13–14	2	15	..	...		
	S.W. 51·8	51·0	46·6 24 fath.	Bottom Tow-net.—*Temora longicornis*, f.; *Podon*, sp. f.; *Sagitta*, sp. f.; small Medusidæ, f.	Lemon sole,	1	12	...	...	...	...		
					Witch sole,	1	11	...	...	...	...		
					Common dabs,	1	9	7	6½	...	...		
					Long rough dabs,	11	8	11	6½	5	5½		
					Haddocks,	3	11	9	7½–6	...	...		
					Cod,	1	18	3	16–17	3	8		
					Whitings,	5	12–13	2	10	1	6		
					Gurnards,	2	13–15	4	11	14	7–9		
					Brassie,	1	8	1	7	...	...		
Station IX. 14th June 1893. 7.50 a.m. to 9.50 a.m.	S.E. 49·8	35·4	44·3 32 fath.	Surface Tow-net.—*Calanus finmarchicus*, r.; *Centropages*, sp. r.; *Anomalocera pattersoni*, f.; young Decapod Crustacea, f.; fish ova, f.	Plaice,	1	14	...	...	...	...	A few *Nephrops* sp. only.	At beginning — Wind S.S.E., force 4; weather, hazy; sea, choppy; tide, low water; barometer, 30·01; transparency, 6 fathoms. At finish — Wind S.E., force 5; weather and sea as before; tide, 2 hours flood; barometer, 30·01; transparency, 4½ fathoms.
					Common dabs,	3	8–9	3	7	...	...		
					Witch soles,	1	18½	1	16	...	...		
					Long rough dabs,	6	9–10	9	8	3	7		
					Haddocks,	3	10½	1	9	232	6–8		
	N.E 51·8	52·5	44·5 293 fath.	Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Sagitta*, sp. fr.; small Medusidæ, fr.; young Lamellibranchs, f.; young Schizopods, f.; young Annelids, fr.; young starfish (Ophiuridæ), fr.	Cod,	5	18–21	5	15–17	12	9–13		
					Whitings,	1	12	6	11	2	9		
					Gurnards,	1	15½	1	11	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Traw down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations
Station X. (Limekilns Station). 20th June 1893. 12.35 p.m. to 1.15 p.m.	E. 63·5	60·3	59·2 7½ fath.	Surface Tow-net.—Young Crustacea, f.; young fish, f. Bottom Tow-net.—*Crangon*, sp. r.; Schizopods (*Mysis*, *Macropsis*, *Gastrosaccus*), fr.; *Diastylis*, sp. f.; *Atylus swammerdami*, r.; *Parapontella*, sp. r.; *Thalestris*, r.; *Alteutha*, sp. r.; *Sagitta*, sp. r.	Grey skate,	1	[illegible]	...	...	...	...	*Hyas araneus*, several; *Carcinus mœnus*, f.; *Portunus*, sp. f.; *Eupagurus bernhardus*, f.; *Tritonia*, sp. r.; a quantity of mud.	At beginning—Wind, calm; weather, overcast; fine sea, smooth; tide, 5½ hours ebb; barometer, 29·89; transparency, ½ fathom. At finish — Wind, weather and sea as before; tide, about low water; barometer, 29·89; transparency, ½ fathom.
	W. 64·4	61·3	60·9 6½ fath.		Thornback rays,	2	21–22	2	15	1	11		
					,, ,,	1	8	...	...	...	...		
					Cod,	3	9	6	5	...	...		
					Whitings,	5	7	4	6	1	4		
					Ling,	1	2	...	...	...	...		
Station I. 31st July 1893. 2.5 p.m. to 4.5 p.m.	E. 57·2	55·9	50·7 15½ fath.	Surface Tow-net. — Young Crustacea very abundant. Bottom Tow-net. — *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; small Medusidæ, fr.; small Crustacea, c.	Plaice,	14	13–14	27	11–12	3	9½–10½		At beginning — Wind S., force 2; weather, fine; sea, slight; tide, 3½ hours flood; barometer, 29·87; transparency, 5½ fathoms. At finish—Wind S.E., force 2; weather, sky cloudy; sea, slight; tide, 5½ hours flood; barometer, 29·87; transparency, 4 fathoms.
	W. 55·2	58·7	52·3 14 fath.		,, ,,	11	8½	...	...	...	...		
					Lemon soles,	8	12	20	10–11	17	8		
					,, ,,	9	6	...	...	...	...		
					Common dabs,	1	11½	7	9	23	6		
					,, ,,	14	5	...	...	...	...		
					Long rough dabs,	5	12	13	8	14	5		
					Turbot,	1	17½	...	...	...	...		
					Haddocks,	1	12	66	8	74	6		
					Cod,	1	29	2	20	16	9–10½		
					,,	15	5–6½	...	...	...	...		
					Whitings,	14	9	38	7	...	...		
					Ling,	1	22	2	13	...	...		
					Gurnards,	1	13	8	10	12	6		
					Anglers,	1	26	1	24	...	...		
					Dragonet,	1	9	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station II. 28th July 1893. 12.30 p.m. to 2.0 p.m.	E. 62·2	56·8	51·6 14½ fath.	Surface Tow-net. — Young Crustacea very abundant.	Plaice,	1	12½	11	11	18	8½		At beginning — Wind, calm; weather, hazy; sea, slight; tide, 4 hours flood; barometer, 30·15; transparency, 5 fathoms.
					,,	4	7	...	...	...	...		
					Lemon soles,	1	16	9	11½-13	14	9-10½		
					,, ,,	21	6-8	...	...	...	...		
	W. 62·6	56·1	52·5 13 fath.	Bottom Tow-net.—*Hyperoche*, sp. r.; *Calanus finmarchicus*, c.; *Temora longicornis*, c.; *Sagitta*, sp. fr.; *Tomopteris*, sp. r.; young Crustacea, fr.	Common dabs,	72	8	133	6	53	4½		At finish—Wind, weather and sea as before; tide, 5½ hours flood; barometer, 30·12; transparency, 4½ fathoms.
					Long rough dabs,	3	11-12½	8	9	16	7		
					,, ,,	4	6	...	...	...	...		
					Haddocks,	14	9	48	7-7½	7	10		
					Cod,	1	17	1	9½	...	..		
					Whitings,	5	7	3	6	...	...		
					Gurnards,	4	13	4	8	9	5		
					Angler	1	16	...	...	...	...		
					Dragonet,	1	8	1	7	...	...		
Station III. 31st July 1893. 11.10 a.m. to 1.40 p.m.	E. 59·9	56·0	55·2 8 fath.	Surface Tow-net. — Young Crustacea very abundant.	Plaice,	25	12-13	27	10-11	12	9		At beginning — Wind N.N.W., force 3; weather, cloudy; sea, slight; tide 1 hour flood; barometer, 29·86; transparency, 3 fathoms.
					,,	15	7	...	...	...	...		
					Lemon soles,	25	11-12	28	9-10	15	7½		
					,, ,,	11	5½	...	...	...	...		
	W. 60·0	56·5	50·9 7½ fath.	Bottom Tow-net. — *Calanus finmarchicus*, fr.; *Temora longicornis*, c.; *Sagitta*, sp. fr.; young Crustacea, ab.	Common dabs,	8	9	27	7	58	6		At finish—Wind E., force 1; weather, sea, as before; tide, 3½ hours flood; barometer, 29·88; transparency, 3½ fathoms.
					,, ,,	26	5	...	...	...	...		
					Long rough dabs,	1	7	3	6	...	...		
					Haddocks,	114	8	80	7	...	...		
					,,	1	20	...	...	...	...		
					Cod,	14	6½	26	10-11½	35	8-9½		
					,,	1	5	...	...	...	...		
					Whitings,	1	13	9	10	2	8		
					Gurnards,	1	13	3	10	1	8		
					,,	2	6	...	...	...	...		
					Anglers,	1	24½	1	22½	2	17-18½		

TABLE C.—Record of Observations made on board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 1st August 1893. 3.25 p.m. to 5.55 p.m.	E. 60·6	56·2	54·8 8½ fath.		Thornback rays,	1	18¼	1	10⅛	...	...		At beginning—Wind W., force 8; weather, dull; sea, slight; tide, 4½ hours flood; barometer, 29·84; transparency, 3 fathoms.
					Plaice,	4	13–14	1	12	3	8-9		
					,,	1	6½	...	...	...	...		
					Common dabs,	4	6½	3	4½	...	...		
	W. 57·3	56·9	56·6 6¼ fath.		Haddocks,	5	8½	2	7½	...	...		
					Cod,	2	11	1	10	1	8		At finish — Wind W., force 2; weather, hazy; sea, slight; tide, ¾ hour ebb; barometer, 29·82; transparency, 2 fathoms.
					,,	1	6½	...	...	...	...		
					Whitings,	2	8	...	...	...	...		
					Gurnard,	1	11	...	...	...	...		
Station V. 28th July 1893. 7.30 a.m to 9.35 a.m.	E. 55·2	54·9	48·7 22 fath.	Surface Tow-net.—*Atylus*, sp. r.; *Anomalocera pattersoni*, r.; *Sagitta*, sp. f.; young Crustacea, c.; young Lumpsuckers, 4.	Grey skate,	1	21	...	...	...	...		At beginning — Wind, calm; weather, hazy; sea, slight, south easterly swell; tide, 5¾ hours ebb; barometer, 30·19; transparency, 7 fathoms.
					Plaice,	3	18	12	14–15	39	12–13		
					,,	12	10–11	...	...	...	...		
					Lemon soles,	6	14⅓	3	11	8	9		
					,, ,,	3	7	...	...	...	...		
	W. 58·6	55·0	49·1 27 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, fr.; *Sagitta*, sp. c.; young Gastropods, f.; young starfishes, f.	Common dabs,	12	8½	20	6	10	5		
					Witch soles,	2	19½	1	18	2	14–16		
					,, ,,	2	12	...	...	...	...		
					Flounder,	1	7	...	...	...	...		
					Long rough dabs,	5	10	27	7½	28	6½		At finish—Wind, weather and sea as before; tide, 1¾ hours flood; barometer, 30·18; transparency, 6¾ fathoms.
					,, ,,	1	4	...	...	...	...		
					Haddocks,	109	8½	747	6–7½	...	...		
					Cod,	2	31-34	2	21–27	2	13–17½		
					,,	9	8	...	...	...	...		
					Whitings,	5	12	3	6	...	...		
					Gurnards,	9	11½	10	8½	9	7		
					Catfish,	1	28	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VI. 28th July 1893. 10.30 a.m. to 11.20 a.m.	E. 58·6	56·1	49·8 14½ fath.	Surface Townet-. — *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; young Crustacea, fr.; young *Aurelia*, f.	Sandy ray,	1	8	...	...	...	...		At beginning — Wind, calm; weather, hazy; sea, slight; tide, 2¾ hours flood; barometer, 30·18; transparency, 7 fathoms. At finish—Wind, weather and sea as before; tide, 3½ hours flood; barometer, 30·16; transparency, 6½ fathoms.
					Plaice,	1	22	3	16–19	27	13–15		
					,,	38	11–12	...	...	...	...		
					Lemon soles,	4	13–13½	13	10–11	3	9		
					,, ,,	7	5	...	...	...	...		
	W. 59·1	56·2	53·0 14 fath.	Bottom Tow-net.—*Atylus*, sp. f.; *Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Caligus*, sp. r.; *Sagitta*, sp. fr.; small Medusidæ, f.; young Gastropods, f.; young Crustacea, fr.	Common dabs,	2	9	11	7	38	6		
					,, ,,	5	4	...	...	...	...		
					Long rough dabs,	4	8	2	6	...	...		
					Brill,	1	17	...	...	...	...		
					Black sole,	1	17½	...	...	...	...		
					Haddocks,	85	7–8	...	...	...	...		
					Cod,	1	18½	7	11	2	7		
					Whitings,	8	11	8	8	3	7		
					Gurnards,	1	15	10	6	6	7		
					,,	4	6	...	...	...	...		
Station VII. 1st August 1893. 1.0 p.m. to 2.35 p.m.	E. 57·7	55·3	51·0 17 fath.		Grey skate,	1	25	2	20	...	...		At beginning — Wind S.E. by E., force 2; weather, cloudy; sea, easterly swell; tide, 2¼ hours flood; barometer, 29·86; transparency, 4½ fathoms. At finish—Wind, weather and sea as before; tide, 3¾ hours flood; barometer, 29·87; transparency, 4 fathoms.
					Plaice,	3	15-16	9	13–14	19	11–12		
					,,	6	8–10	...	...	...	...		
					Lemon soles,	4	11–12	1	9	1	7		
	W. 58·4	56·1	54·3 12½ fath.		Common dabs,	1	11½	6	8–9	218	6–7		
					,, ,,	15	5	...	...	...	...		
					Long rough dabs,	11	8	10	7	...	...		
					Haddocks,	1	12	4	9½	485	8		
					,,	306	6–7	...	...	...	...		
					Cod,	1	11	1	10	...	...		
					Whitings,	1	12	12	11	5	9		
					Gurnards,	7	11–12	5	8	12	5		
					Dragonet,	2	8	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VIII. 27th July 1893. 12.15 p.m. to 2.40 p.m.	S.W. 63·8	56·0	49·4 22 fath.	Surface Tow-net. — *Calanus finmarchicus*, f.; young Crustacea, fr.; small Medusids, fr.	Grey skate,	1	19	1	3	...	...		At beginning — Wind E.N.E., force 1; weather, cloudy; sea, easterly swell; tide, 5 hours flood; barometer, 30·15; transparency, 5½ fathoms.
					Starry ray,	1	9½	1	12	...	...		
					Plaice,	1	24	6	13–14	5	11–12½		
					,,	1	9	...	...	...	...		
	N.E. 64·4	56·9	48·0 27 fath.	Bottom Tow-net. — *Hyperoche*, sp. f.; *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Sagitta*, sp. c.; young Crustacea, fr.	Lemon soles,	1	17	3	12–13	10	10–11		
					,, ,,	6	9	...	...	...	...		
					Witch soles,	2	17	3	14–15	2	11		
					,, ,,	1	9	...	...	...	...		
					Common dabs,	2	10	1	9	26	5½–6½		At finish—Wind, weather and sea as before; tide, 1 hour ebb; barometer, 30·15; transparency, 10 fathoms.
					Long rough dabs,	1	9½	26	7½	15	6½		
					,, ,,	1	4	...	...	...	...		
					Haddocks,	3	12	4	9	78	6–7½		
					Cod,	2	24–26	5	19–21	5	14–17		
					,,	6	7–10	...	...	...	...		
					Whitings,	5	11	6	6	...	...		
					Gurnards,	11	13	16	8½	9	6		
					Brassie,	2	7½	1	6½	...	...		
					Angler,	1	22	...	...	...	...		
					Catfish,	1	31	...	...	...	...		
					Hake,	1	15	...	...	...	...		
Station IX. 27th July 1893. 3.30 p.m. to 5.30 p.m.	N.W. 56·8	56·9	48·2 29 fath.	Surface Tow-net. — *Calanus finmarchicus*, fr.; *Caligus rapax*, f.; *Sagitta*, sp. c.; small Medusids, r.; young Crustacea, f.	Starry rays,	2	12	1	11	...	...		At beginning — Wind E.N.E., force 1; weather, cloudy; sea, easterly swell; tide, 2 hours ebb; barometer, 30·16; transparency, 10 fathoms.
					Common dabs,	1	9½	1	7	...	...		
					Long rough dabs,	7	8–9	36	7½	17	6		
					,, ,,	3	4	...	...	...	...		
					Haddocks,	2	12	1	8	5	9		
	S.E. 58·8	56·0	47·4 33 fath.	Bottom Tow-net. — *Calanus finmarchicus*, f.; *Anomalocera pattersoni*,	,,	132	6–7	...	...	...	...		
					Cod,	1	18½	1	11	2	9½		
					,,	3	6	...	...	...	...		

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1893.—I. FIRTH OF FORTH—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
STATION IX. 27th July 1893. 3.30 p.m. to 5.30 p.m. —*continued.*				f.; *Sagitta*, sp. f.; young Crustacea, c.	Whitings, . .	3	12	3	11	2	8½		At finish—Wind S.E., force 2; weather and sea as before; tide, 4 hours ebb; barometer, 30·18; transparency, 9½ fathoms.
					,, . .	2	7½	...	...	...	...		
					Gurnards, . .	2	12–13	11	10–12	13	9		
					,, . .	1	7	...	...	...	...		
					Angler, . .	1	27	...	...	...	...		
STATION I. 24th Aug. 1893. 11.5 a.m. to 12.55 p.m.	E. 62·6	51·0	55·4 15½ fath.	Surface Tow-net.—*Hyperoche*, sp. r.; *Pleurobrachia*, f.; young Crustacea, fr.; young *Aurelia*, r.	Thornback rays, .	1	13	...	...	...	...	Cuttle fish, r.; *Carcinus mœnus*, r.; *Pecten opercularis*, f.; *Nephrops norvegicus*, c.; *Asterias rubens*, fr.; *Solaster papposa*, r.	At beginning — Wind W. by N., force 5; weather, cloudy; sea, choppy; tide, 4 hours flood; barometer, 29·79; transparency, 5½ fathoms.
					Plaice, . .	3	15	18	13	24	11½		
					,, . .	22	8½–9½	...	...	...	...		
					Lemon soles, .	4	13	31	10–11	13	9		
					,, ,, .	20	7½	...	...	...	...		
	W. 64·4	56·0	54·6 9¾ fath.	Bottom Tow-net.—*Hyperoche*, sp. f.; *Calanus finmarchicus*, f.; *Caligus rapax*, r.; *Sagitta*, sp. fr.; Medusidæ, ab.; young Gastropods, f.; young Crustacea, f.	Common dabs, .	8	8–9	20	7–6	40	5½		At finish—Wind, weather and sea as before; tide, high water; barometer, 29·83; transparency, 3¾ fathoms.
					Long rough dabs,	11	8	25	6½	...	...		
					Haddocks, . .	1	9½	47	8½	19	7		
					Cod, . . .	2	20	9	11–10	12	8–9		
					,, . . .	7	5	...	...	...	...		
					Whitings, . .	8	11½	25	9	37	7		
					Gurnards, . .	10	13	15	9½	16	7		
					Anglers, . .	1	29	1	27	1	26		
					,,	1	25	...	...	...	...		
STATION II. 25th Aug. 1893. 11.25 a.m. to 12.55 p.m.	E. 59·9	56·0	53·4 15 fath.	Surface Tow-net.—*Calanus finnarchicus*, f.; *Temora longicornis*, fr.; *Acartia*, sp. fr.; *Caligus*, sp. r.; *Sagitta*, sp. f.; *Tomopteris*, sp. r.; Medu-	Thornback rays, .	1	17½	1	16	...	...	Cuttle fish, r.; *Portunus*, sp. f.; *Ophiothrix rosula*, f.; *Solaster papposa*, r.; Zoophytes,	At beginning — Wind W., force 4; weather, cloudy; sea, slight; tide, 4 hours flood; barometer, 30·09;
					Plaice, . .	2	13½	11	11–12	13	10		
					,, . .	10	7½	...	...	...	...		
					Lemon soles, .	5	10–11	1	13½	14	8–9		
					,, ,, .	5	5½	...	...	...	...		
					Common dabs, .	17	8	71	7	196	5–6		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station II. 25th Aug. 1893.	E. 59·9	56·0	11·9 15 fath.	sidæ, f.; young Crustacea, f.	Common dabs, .	4	4	...	...	...	...	f.; large *Cyanea*, l.	transparency, 4½ fathoms.
11.25 a.m. to 12.55 p.m. —*continued.*	W. 59·9	56·0	13·0 14½ fath.	Bottom Tow-net.— *Hyperoche*, sp. r.; *Idotea marina*, r.; Medusidæ, ab.; young Crustacea, f.	Long rough dabs,	1	12½	10	9½	10	7–8½		At finish — Wind W.N.W., force 4; weather and sea as before; tide, 5½ hours flood; barometer, 30·09; transparency, 5 fathoms.
					„ „ .	1	4	...	...	...	...		
					Haddocks, . .	32	9	91	7½	...	...		
					Cod, . . .	2	13	4	9	...	...		
					Whitings, . .	2	10	1	9	2	7½		
					Gurnards, . .	6	14	2	9½	13	6½		
					Angler, . .	1	25	...	...	...	...		
Station III. 24th Aug. 1893. 1.20 p.m. to 3.30 p.m.	W. 64·4	56·0	11·6 9 fath.	Surface Tow-net. — Young Crustacea, fr.; *Temora longicornis*, f.; *Evadne*, f.; *Pleurobrachia*, fr.	Thornback rays, .	2	19–20½	1	17	2	15–16	*Pecten opercularis*, c.; Cuttle fish, r.; *Portunus*, sp. fr.; *Eupagurus*, sp. f.; *Nephrops norvegicus*, fr.; *Asterias rubens*, f.; *Ophiothrix rosula*, f.; *Solaster papposa*, f.; *Echinus esculentus*, fr.; *Aphrodite*, sp. 1; *Alcyonium*, sp. f.	At beginning — Wind W. by N., force 5; weather, cloudy; sea, choppy; tide, high water; barometer, 29·83; transparency, 4 fathoms. At finish — Wind W. by N., force 3; weather, cloudy; sea, slight; tide, 2¼ hours ebb; barometer, 29·89; transparency, 3½ fathoms.
					„ „ .	2	12–14	...	...	...	...		
					Plaice, . .	22	12–13	30	10–11	19	9		
					„ . .	1	7	...	...	...	...		
					Lemon soles, .	2	15	17	11–12	20	8½		
					„ „ .	46	6–7	...	...	...	...		
	E. 64·0	56·9	12·6 12 fath.	Bottom Tow-net.— *Hyperia*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. ab.; *Tomopteris*, sp. f.; young Crustacea, fr.	Common dabs, .	1	11	8	9	91	6–7		
					„ „ .	2	4	...	...	...	...		
					Long rough dab,	1	3	...	...	...	...		
					Haddocks, . .	162	8½	44	7½	...	...		
					Cod, . . .	1	32	1	16½	9	12		
					„ . . .	34	7½–9	...	..	...	...		
					Whitings, . .	2	11	10	10	9	7½		
					Gurnards, . .	11	14	14	9½	30	6½		
					Angler, . .	1	24	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 25th Aug. 1893. 2.20 p.m. to 4.55 p.m.	W. 60·2	57·4	56·8 6 fath.	Surface Tow-net. — *Pleurobrachia*, sp. v. ab.; young Crustacea, c.	Thornback rays, .	1	23½	2	20½–21½	4	18½–19½	*Pecten opercularis*, ab.; Cuttle fish, r.; *Tritonia*, sp. r.; *Portunus*, sp. r.; *Asterias rubens*, f.; *Solaster papposa*, r.; *Chalina*, sp. f.	At beginning — Wind N.W.; force 5; weather, cloudy; sea, choppy; tide, ¾ hours ebb; barometer, 30·10; transparency, 2 fathoms. At finish — Wind W.N.W., force 5; weather and sea as before; tide, 3¼ hours ebb; barometer, 30·11; transparency, 2 fathoms.
	E. 59·5	56·4	55·7 9 fath.	Bottom Tow-net. — *Pleurobrachia*, v. ab.	Plaice, . .	1	19½	4	12–13	33	9½–11		
					,, . .	26	6–8	...	...	...	...		
					Lemon soles, .	1	12	4	6	...	...		
					Common dabs, .	2	10–11	3	9	25	7		
					,, ,, .	3	5–6	...	...	...	...		
					Long rough dab,	1	9	...	...	...	...		
					Haddocks, . .	2	9	2	7½	3	6½		
					Cod, . . .	1	10	2	8	1	5½		
					Whiting, . .	1	8	...	...	...	...		
Station V. 29th Aug. 1893. 2.55 p.m. to 5.5 p.m.	E. 65·3	56·2	52·7 24¾ fath.	Surface Tow-net.—*Hyperoche*, sp. r.; *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Acartia*, sp. f.; *Centropages*, sp. f.; *Sagitta*, sp. r.; small Medusidæ, f.; young Crustacea, fr.; fish ova, v. r.	Plaice, . .	1	18	5	15–16	8	13–14	Cuttle fish, f.; *Nephrops norvegicus*, ab.	At beginning — Wind W., force 1; weather, hazy; sea, slight easterly swell; tide, 4¾ hours flood; barometer, 30·21; transparency, 9 fathoms. At finish—Wind W.N.W., force 1; weather, cloudy, fine; sea, smooth; tide, 1 hour ebb; barometer, 30·21; transparency, 5½ fathoms.
					,, . .	6	11–12	...	...	...	...		
					Lemon soles, .	1	11	1	8	...	...		
					Common dabs, .	2	10	4	8	9	6		
					Witch sole, .	1	17½	...	...	...	...		
					Long rough dabs,	2	10–11	22	8–9	21	7		
					,, . .	17	4½	...	...	...	...		
	W. 62·6	55·9	58·6 31 fath.	Bottom Tow-net.—*Atylus bispinosus*, r.; *Caprella*, sp. r.; *Cumacea*, sp. f.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Acartia*, sp. f.; *Sagitta*, sp. fr.; small Medusidæ, f.; young Gastropods, f.; young Crustacea, fr.; young starfish, f.; young fish, f.	Haddocks, . .	16	9	565	7–8	...	...		
					Cod, . . .	2	26–29	1	22	3	19		
					,, . .	6	8–9	...	...	...	...		
					Whitings, . .	1	12	9	10	5	8		
					Gurnards, . .	3	12	27	9	29	7–8		
					,, . .	12	6	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VI. 30th Aug. 1893. 8.20 a.m. to 9.10 a.m.	W. 55·4	55·5	54·5 15 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Acartia*, sp. f.; small Medusids, f.; young *Motella mustela*, 1; young Gastropods, f.; young Crustacea, fr.	Plaice,	1	17½	4	14	3	12½	*Solaster papposa*, *S. endeca*, f.; *Pecten opercularis*, r.	At beginning—Wind S.W., force 3; weather, hazy; sea, slight; tide, 4¼ hours ebb; barometer, 30·11; transparency, 6½ fathoms. At finish—Wind W.S.W., force 3; weather and sea as before; tide, 5¼ hours ebb; barometer, 30·12; transparency, 4½ fathoms.
					Lemon soles,	6	13	2	11–12	5	10		
					,,	1	8	...	...	...	...		
					Common dabs,	17	8	3	7	3	5		
					Haddocks,	34	9	102	7–8	...	...		
	E. 62·6	55·0	54·5 4 fath.	Bottom Tow-net.—*Atylus bispinosus*, f.; *Calanus finmarchicus*, fr.; *Temora longicornis*, fr.; *Parapontella brevicornis*, r.; *Sagitta*, sp. c.; small Medusids, c.; young Gastropods, fr.; young Crustacea, f.; young starfish, fr.; young fish, f.	Cod,	1	30	3	21–25	16	18–19		
					,,	8	14–15	12	12–13	3	9½		
					Whitings,	2	13	7	12	4	10		
					Saithe,	1	15	...	...	...	...		
					Gurnards,	2	13	3	10	8	7		
Station VII. 28th Aug. 1893. 2.30 p.m. to 4.20 p.m.	W. 63·3	57·8	56·1 12¾ fath.	Surface Tow-net.—*Parathemisto*, sp. r.; *Calanus finmarchicus*, f.; Medusidæ, fr.; young Crustacea, c.; young Lumpsucker, l.	Grey skates,	1	20	2	18–19	3	16–17	*Asterias rubens*, f.; *Astropecten*, r.; *Solaster papposa*, *S. endeca*, f.; *Alcyonium*, sp. f.	At beginning—Wind W., force 1; weather, cloudy; sea, slight easterly swell; tide, 5½ hours flood; barometer, 30·27; transparency, 3½ fathoms. At finish—Wind variable, light; weather, dull; sea, easterly swell; tide, 1½ hours ebb;
					Thornback ray,	1	6	...	...	...	...		
					Plaice,	3	17½	10	14–16	18	12–13		
					,,	13	10–11	...	...	...	...		
					Lemon soles,	1	12	5	10–11	2	8		
					,, ,,	1	6	...	...	...	...		
	E. 60·8	57·2	53·4 16½ fath.	Bottom Tow-net.—*Atylus*, sp. f.; *Hyperoche*, sp. r.; *Iphimedia*, sp. r.; *Temora*, *Centropages*, sp. f.; young Gastropods, f.; young fish, fr.; young Crustacea, f.; young starfish, f.	Common dabs,	1	10	4	9	73	7½		
					,, ,,	215	4½–6	...	...	...	...		
					Witch sole,	1	20½	...	...	...	...		
					Long rough dabs,	2	9	5	8	2	6		
					Haddocks,	2	12½	54	9½	224	8½		
					,,	1053	6½–7½	...	...	...	...		
					Cod,	1	12	5	10	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Date, and Time Trawl down.	Temperature. Air. Dry Bulbs.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VII. 28th Aug. 1893. 2.30 p.m. to 4.20 p.m. —*continued.*					Whitings, . .	3	11	9	8½	44	7		barometer, 30·27; transparency, 4½ fathoms.
					Gurnards, . .	2	12	1	9	2	8		
					,, . .	35	5-6½	...	...	...	...		
					Angler, . .	1	16	...	...	...	...		
					Dragonet, . .	6	8	...	...	...	...		
Station VIII. 29th Aug. 1893. 10.45 a.m. to 1.10 p.m.	N.E. 57·2	55·3	54·1 28¼ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Acartia*, sp. f.; *Anomalocera pattersoni*, r.; *Sagitta*, sp. r.; Medusidæ, f.; young Crustacea, f.; fish ova, f.	Plaice, . .	1	14	...	...	...	...	Cuttle fish, f.; *Nephrops norvegicus*, f.; *Actinoloba*, sp.; *Alcyonium*, sp. f.	At beginning — Wind W., force 4; weather, cloudy; sea, choppy; tide, 1¼ hours flood; barometer, 30·25; transparency, 7½ fathoms. At finish—Wind W., force 2; weather, hazy; sea, slight; tide, 3½ hours flood; barometer, 30·24; transparency, 7½ fathoms.
					Lemon soles, .	5	12-14	7	10-11½	1	7		
					Common dabs, .	1	8⅜	10	7	...	...		
					Witch soles, .	1	18½	1	16½	...	...		
					Long rough dabs,	5	11	12	9	29	7		
					,, ,, .	2	4⅓	...	...	...	...		
					Haddocks, .	1	14	2	13	12	9½		
	S.W. 66·2	56·8	51·4 26½ fath.	Bottom Tow-net contained a quantity of mud.	,, . .	721	7-8	...	...	...	...		
					Cod, . . .	1	30½	2	22	4	18-19½		
					,, . .	1	6	...	...	...	...		
					Whitings, . .	11	12	4	10	6	7		
					Ling, . . .	1	11	...	...	...	...		
					Gurnards, . .	5	12	10	10	10	8		
					Angler, . .	1	15½	...	...	...	...		
Station IX. 29th Aug. 1893. 7.45 a.m. to 9.50 a.m.	S.E. 56·6	55·8	51·0 32 fath.	Surface Tow-net damaged.	Starry ray, .	1	13½	...	...	...	...	Cuttle fish, f.; *Nephrops norvegicus*, fr.; *Asterias rubens*, f.; *Solaster endeca*, f.; *Aurelia*, f.	At beginning — Wind W., force 5; weather, cloudy; sea, choppy; tide, 4½ hours ebb; barometer, 30·25; transparency, 7½ fathoms.
					Plaice, . .	4	15-16	1	13	...	...		
					Common dabs, .	2	10	5	6	...	...		
	N.W. 56·4	56·0	50·7 34 fath.	Bottom Tow-net. —*Hyperoche*, sp. f.; *Iphimedia*, sp. r.; *Atylus*, sp. fr.; *Calanus finmarchicus*, f.;	Sail fluke, . .	1	19	...	...	...	...		
					Long rough dabs,	1	9½	25	8	27	6-7		
					,, ,,	9	4	...	...	...	...		
					Haddocks, . .	18	9½	737	7-8	1	5½		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IX. 29th Aug. 1893. 7.45 a.m. to 9.50 a.m. —*continued.*				*Temora longicornis*, f.; *Centropages*, sp. r.; *Sagitta*, sp. ab.; young fish, fr.; young Gastropods, f.; young Crustacea, f.; young Echinoderms, fr.	Cod,	1	24½	4	21–22	2	18–19½		At finish—Wind, weather and sea as before; tide, ½ hour flood; barometer, 30·25; transparency, 8 fathoms.
					,,	1	16½	5	11½–13	5	8–9		
					Whitings,	1	14	20	12	9	9		
					,,	23	7	...	...	...	...		
					Gurnards,	4	14	12	12–13	12	10		
					,,	8	8	...	...	...	...		
					Anglers,	1	30	1	11	...	...		
Station I. 20th Sept. 1893. 10.25 a.m. to 12.5 p.m.	W. 56·3	54·4	53·9 13½ fath.	Surface Tow-net. — Boreophausidæ, fr.; *Hyperoche*, sp. r.; *Calanus finmarchicus*, f.; small Medusæ, f.; young Crustacea, fr.	Plaice,	20	13	11	11–12	10	2		At beginning—Wind W., force 5; weather, cloudy; sea, slight; tide, ½ hour ebb; barometer, 29·32; transparency, 3 fathoms.
					,,	8	6	...	...	...	...		
					Lemon soles,	7	14	16	11–12	29	8½–10		
					,, ,,	10	5–6½	...	...	...	...		
					Common dabs,	1	13½	5	9½	30	6–7½		
					,,	4	5	...	...	...	...		
	E. 54·8	54·8	54·1 14½ fath.	Bottom Tow-net. — *Thysanoessa*, sp. f.; *Hyperoche*, sp. r.; *Calanus finmarchicus*, f.; *Caligus*, sp. r.; *Sagitta*, sp. c.; *Tomopteris*, sp. fr.; small Medusæ, fr.; young Gastropoda, fr.; young Crustacea, fr.	Long rough dabs,	3	10	1	8	8	7		At finish—Wind, weather and sea as before; tide, 2 hours ebb; barometer, 29·35; transparency, 3½ fathoms.
					Haddocks,	2	9	...	...	...	...		
					Cod,	1	20½	1	11½	3	8		
					Gurnards,	1	16	7	10	8	6½		
					Hake,	1	16	...	...	...	...		
					Anglers,	1	29	2	24	...	...		
					Pogge,	1	3½	...	...	...	...		
Station II. 20th Sept. 1893. 12.40 p.m. to 2.15 p.m.	W. 55·2	55·2	54·5 13 fath.	Surface Tow-net.—*Sagitta*, sp.f.; small Medusæ, f.; young Crustacea, c.	Thornback ray,	1	16	...	...	...	...		At beginning—Wind W., force 5; weather, cloudy; sea, slight; tide 2¾ hours ebb; bar-
					Plaice,	2	14–15	5	11–12	23	9–10		
					,,	19	8	...	...	...	...		
				Bottom Tow-net. — *Atylus*, sp. r.; *Calanus fin-*	Lemon soles,	2	12½	13	10–11	4	8		
					,, ,,	5	6	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station II. 20th Sept. 1893. 12.40 p.m. to 2.15 p.m. —*continued.*	E. 56·1	54·9	53·9 13½ fath.	*marchicus*, f.; *Caligus*, sp. f.; *Sagitta*, sp. ab.; *Tomopteris*, sp. fr.; small Medusæ, f.; young Gastropods, fr.; young Crustacea, ab.	Common dabs,	8	10	163	7–8	77	5½		ometer, 29·35; transparency, 3½ fathoms. At finish—Wind W.N.W., force 4; weather and sea as before; tide, 4½ hours ebb; barometer, 29·35; transparency, 4 fathoms.
					,, ,,	25	4½	...	...	...	...		
					Long rough dabs,	7	11–12½	13	10	26	7		
					,, ,,	3	6	...	...	...	...		
					Haddocks,	32	8½	8	7	...	...		
					Cod,	1	13	1	8	...	...		
					Whitings,	8	9	...	...	...	...		
					Gurnards,	3	13	8	7½	...	...		
Station III. 21st Sept. 1893. 12.45 p.m. to 3.25 p.m.	W. 49·6	54·3	53·4 7½ fath.	Surface Tow-net.—Small Medusæ, c.; young Crustacea, f.	Grey skates,	1	22	1	7	...	...		At beginning — Wind N., force 4; weather, cloudy; sea, slight; tide, ¾ hour ebb; barometer, 29·46; transparency, 3½ fathoms. At finish—Wind N., force 5; weather and sea as before; tide, 3½ hours ebb; barometer, 29·48; transparency, 3 fathoms.
					Thornback ray,	1	23	...	...	...	...		
					Plaice,	5	13	16	11	13	10		
	E. 47·3	54·7	54·3 8 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. ab.; *Tomopteris*, sp. fr.; small Medusæ, f.; young Gastropods, fr.; young Crustacea, fr.	Lemon soles,	7	10–11	2	12½	26	9		
					,, ,,	22	7	...	...	...	...		
					Common dabs,	7	9½	22	7½	57	6		
					,, ,,	5	4	...	...	...	...		
					Long rough dabs,	1	14	17	8	14	6		
					,, ,,	3	4	...	...	..	...		
					Turbot,	1	25	...	...	...	...		
					Haddocks,	1	16	11	10	16	9		
					,,	23	7	...	...	...	...		
					Cod,	2	10	15	9	14	7½		
					Whitings,	1	14	16	11	6	7		
					Brassie,	1	8	...	...	...	...		
					Ling,	1	22	1	16	...	...		
					Gurnards,	5	15	8	10	8	7		
					Anglers,	2	20–24	1	15	3	13		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 22nd Sept. 1893. 10.30 a.m. to 12.50 p.m.	W. 51·4	53·3	53·4 5 fath.	Surface Tow-net.—Small Medusæ, c.; young Crustacea, r.; *Caligus*, sp. r.; some broken molluscan shells.	Thornback rays,	4	18–21	3	14–16	1	10		At beginning — Wind N., force 5; weather, cloudy; sea, choppy; tide, 4 hours flood; barometer, 29·58; transparency, 2½ fathoms. At finish—Wind, weather and sea as before; tide, ½ hour ebb; barometer, 29·58; transparency, 1½ fathoms.
					,, ,,	1	6	...	...	...	...		
					Plaice,	9	12–13½	82	10–11	81	9		
					,,	30	7	...	...	...	...		
	E. 50·3	53·5	53·0 7 fath.	Bottom Tow-net.—Small Medusæ, c.; young Crustacea, fr.; young rocklings, 2.	Lemon soles,	1	13	3	11	11	7		
					Common dabs,	6	9	110	7½	45	6		
					Flounder,	1	11	...	...	...	...		
					Long rough dabs,	1	13	5	9	...	...		
					Haddocks,	22	9	52	7½	...	...		
					Cod,	1	21	5	12–13½	16	10–11		
					,,	1	7½	...	...	...	...		
					Whitings,	1	10	9	8	...	...		
					Gurnards,	17	13	32	10	44	7		
					,,	6	5	...	...	...	...		
					Anglers,	2	15	1	14	...	...		
Station V. 18th Sept. 1893. 10.45 a.m. to 1.0 p.m.	W. 55·9	55·2	52·1 28½ fath.	Surface Tow-net. — Small Medusæ, f.; young Crustacea, r.	Thornback ray,	1	20	...	...	...	...		At beginning — Wind W., force 5; weather, hazy, with rain; sea, choppy; tide, 2¾ hours ebb; barometer, 29·40; transparency, 5 fathoms. At finish—Wind W., force 6; weather, cloudy; sea choppy; tide, 5¾ hours ebb; barometer, 29·42; transparency, 5½ fathoms.
					Plaice,	3	15–16	16	13–14	4	12		
					Lemon soles,	1	17	2	15	3	13		
					,, ,,	1	10	...	...	...	...		
	E. 57·5	54·3	53·7 21½ fath.	Bottom Tow-net. — *Hyperoche*, sp. r.; *Argissa hamatipes*, f.; *Atylus bispinosus*, f.; *Calanus finmarchicus*, fr.; *Caligus*, sp. f.; *Temora longicornis*, f.; *Sagitta*, sp. ab.; *Tomopteris*, sp. fr.; young Gastropoda, f.; young Crustacea, c.; young starfish, f.	Common dabs,	1	11½	1	10	12	7–8		
					,, ,,	18	5½–6½	...	...	...	...		
					Witch soles,	1	18	...	...	...	...		
					Long rough dabs,	44	10	60	8	13	6		
					,, ,,	6	4	...	...	...	...		
					Haddocks,	196	9	1	12	257	7½		
					Cod,	1	22	2	21	1	18½		
					,,	2	9½	...	...	...	...		
					Whitings,	4	10½	10	7½	...	...		
					Gurnards,	4	14½	7	8	5	6		
					Anglers,	1	26	1	24	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VI. 26th Sept. 1893. 3.50 p.m. to 4.40 p.m.	W. 46·4	53·0	52·7 16 fath.	Surface Tow-net.—Small Medusæ, c. Bottom Tow-net.—*Mysis*, sp. f.; *Hyperoche*, sp. f.; *Atylus*, sp. f.; *Calanus finmarchicus*, f. *Sagitta*, sp. c.; small Medusæ, c.; young Gastropoda, fr.; young Crustacea, fr.; young starfish, f.; young fish, f.	Plaice,	3	21–25	35	15–16	36	13–14	*Solaster endeca*, f.	At beginning—Wind S.E., force 5; weather, hazy, with rain; sea, choppy; tide, ¾ hour ebb; barometer, 29·82; transparency, 3¼ fathoms. At finish — Wind E.S.E., force 5; weather, hazy; sea, choppy; tide, 1¼ hours ebb; barometer, 29·83; transparency, 3½ fathoms.
	E. 45·8	53·0	52·5 14 fath.		,,	16	11–12	...	...	...	...		
					Lemon soles,	1	13	8	9	2	8		
					,,	1	6	...	..	...	...		
					Common dabs,	10	10	35	6	...	...		
					Brill,	1	26	1	21	3	17–18		
					,,	1	13	...	...	...	...		
					Haddocks,	23	9	19	8	...	...		
					Cod,	1	15	...	...	...	...		
					Gurnards,	2	10	...	...	...	...		
					Angler,	1	29	...	...	...	...		
Station VII. 26th Sept. 1893. 12.40 p.m. to 2.40 p.m.	E. 46·0	53·2	52·8 15 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. f.; small Medusæ, c.; young Crustacea, f. Bottom Tow-net.—*Sagitta*, sp. fr.; young Gastropoda, fr.; young Lamellibranchs, f.; young Crustacea, f.; young starfish, f.; small Medusæ, f.	Thornback rays,	2	18–19½	1	16	2	14–15	*Cancer pagurus*, f.; *Nephrops norvegicus*, f.; *Eupagurus*, sp. f.; *Solaster endeca*, f.; *Alcyonium*, f.; *Aurelia*, f.	At beginning — Wind S.E., force 4; weather, overcast; sea, easterly swell; tide, 4 hours flood; barometer, 29·85; transparency, 2 fathoms. At finish—Wind weather and sea as before; tide, high water; barometer, 29·85; transparency, 2½ fathoms.
					,, ,,	1	9½	...	...	...	...		
					Plaice,	5	12–13	2	11	...	...		
					Lemon soles,	1	12	...	...	...	...		
	W. 47·1	52·8	52·1 13 fath.		Common dabs,	1	10	10	7	20	6		
					Witch soles,	1	18½	1	17½	...	...		
					Long rough dabs,	4	10	7	8	3	6		
					Haddocks,	12	11	106	9	427	8		
					,,	9	6	...	...	...	...		
					Cod,	2	16–19½	3	11½–13½	10	9½–10½		
					,,	5	7	...	...	...	...		
					Whitings,	2	9½	9	8	...	...		
					Gurnard,	1	6	...	...	...	...		
					Anglers,	1	17	1	12	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VIII. 18th Sept. 1893. 7.15 a.m. to 9.15 a.m.	W. 58·6	55·3	54.5 21 fath.	Surface Tow-net. — *Hyperoche*, sp. r.; small Medusæ, f.; young Crustacea, f.	Grey skate,	1	20½	1	17	1	15½		At beginning — Wind W., force 1; weather, hazy; sea, slight; tide, ¼ hour ebb; barometer, 29·80; transparency, 3½ fathoms.
					,,	1	13	...	...	...	...		
					Plaice,	1	23	1	21	2	16		
					,,	3	13	...	...	...	...		
	E. 56·6	54·3	51·8 29 fath.	Bottom Tow-net.—*Atylus*, sp. f.; *Argissa hamatipes*, fr.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Caligus*, sp. c.; *Sagitta*, sp. c.; *Tomopteris*, sp. fr.	Lemon soles,	1	16	1	12	1	10½		At finish—Wind W., force 4; weather and sea as before; tide, 2¼ hours ebb; barometer, 29·46; transparency, 5½ fathoms.
					,,	1	9	...	...	...	...		
					Common dabs,	12	7½	20	5½	...	...		
					Witch soles,	1	19	4	12½–14	1	11½		
					,,	1	9	...	...	...	...		
					Long rough dabs,	12	9	36	6½	3	4½		
					Haddocks,	164	9	339	7½	...	...		
					Cod,	1	36	3	21	3	9½		
					Whiting,	1	7½	...	...	...	...		
					Ling,	1	15	...	...	...	...		
					Gurnards,	8	12	10	6½	...	...		
Station I. 25th Oct. 1893. 2.10 p.m. to 4.5 p.m.	W. 47·3	51·4	51·4 9½ fath.	Surface Tow-net. — *Parathemisto*, sp. f.; *Pleurobrachia*, fr.; young Crustacea, fr.	Thornback rays,	1	25	1	17⅛	1	11	*Pecten opercularis*, f.; *Mytilus modiolus*, f.; *Eledon*, sp. r.; *Loligo*, sp. f.; *Nephrops norvegicus*, c.; *Asterias*, sp. f.; *Solaster papposa*, *S. endeca*, f.; *Echinus esculentus*, f.	At beginning — Wind W.N.W., force 7; weather, rainy; sea, choppy; tide, about high water; barometer, 29·51; transparency, 2 fathoms.
					Plaice,	7	12½–14	28	10½–12	3	9½		
					Lemon soles,	3	12	11	9	12	7		
					Common dabs	1	10	7	8	10	6		
					Long rough dabs,	7	10	8	7½	...	...		
					Haddocks,	7	10	44	7–8½	...	...		
	E. 47·6	51·7	51·4 15 fath.	Bottom Tow-net.—*Mysis*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. c.; *Tomopteris*, sp. f.; young long rough dab, f.; young Crustacea, f.; small Medusæ, f.	Cod,	3	23–25	3	19½–22½	3	13–14½		
					,,	2	10–12½	10	8	...	...		At finish—Wind W., force 6; weather, hazy; sea as before; tide, 1¾ hours ebb; barometer, 29·52; transparency, 2½ fathoms.
					Whitings,	12	10	7	8	...	...		
					Gurnards,	2	13	3	10	1	7		
					Angler,	1	19½	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.				No	Inches	No.	Inches	No.	Inches		
	Dry Bulb.	Surface.	Bottom.										
Station II. 25th Oct. 1893. 11.35 a.m. to 1.5 p.m.	E. 48·9	51·5	51·4 12 fath.	Surface Tow-net.—*Parathemisto*, sp. f. ; *Aurelia*, sp. r. ; *Pleurobrachia*, sp. fr.; young Crustacea, fr.	Plaice, . .	3	13½	22	11–12	22	10	*Pecten opercularis*, f.; Cuttle fish, r.; *Solaster papposa*, f.; *Ophiothrix rosula*, f.; *Alcyonium*, sp. f.	At beginning—Wind W.S.W.; force 5 ; weather, rainy ; sea, slight; tide, 3½ hours flood; barometer, 29·54; transparency, 2½ fathoms.
					,, . .	9	9	...	...	...	...		
					Lemon soles, .	1	15	2	13	6	11-12		
					,, ,, .	5	8–9½	...	...	...	...		
	W. 47·4	51·8	51·6 14½ fath.	Bottom Tow-net. — *Hyperoche*, sp. r. ; *Calanus finmarchicus*, fr. ; *Temora longicornis*, f. ; *Centropages*, sp. f.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Tomopteris*, sp. fr. ; young Crustacea, fr.; young starfish, f.	Common dabs, .	1	10¾	19	7½	19	6		
					Long rough dabs,	1	13	9	11	7	8–9		
					,, ,,	1	4	...	...	...	...		
					Haddocks, . .	47	9½	80	8½	...	...		At finish — Wind W., force 4; weather and sea as before; tide, 5 hours flood; barometer, 29·52 ; transparency, 2½ fathoms.
					Cod, . . .	1	22	2	18½–21	2	13–14		
					,, . .	3	9–10	...	...	...	...		
					Whitings, . .	10	9	3	8	...	...		
					Gurnards, . .	1	17	2	13	5	10		
					,, . .	4	6½	...	...	...	...		
Station III. 27th Oct. 1893. 11.10 a.m. to 1.55 p.m.	E. 45·5	49·7	49·6 7 fath.	Surface Tow - net damaged.	Thornback rays, .	1	25½	1	19½	1	11¾	*Pecten opercularis*, c.; *Nephrops norvegicus*, fr.; *Loligo*, sp. f.; *Solaster papposa*, f.; *Ophiothrix rosula*, f.; *Echinus esculentus*, f.	At beginning — Wind N.W., force 6; weather, hazy; sea, choppy ; tide, 1¾ hours flood ; barometer, 29·80; transparency, 2 fathoms.
					Plaice, . .	2	16–19	3	13½–14½	1	12		
					,, . .	2	8–9	...	...	...	...		
	W. 49·4	51·2	51·2 11 fath.	Bottom Tow-net.—Boreophausidæ, fr. ; *Macropsis slabberi*, f.; *Parathemisto*, sp.; *Metopa*, sp. f. ; *Calanus finmarchicus*, f. ; *Temora longicornis*, f.; *Caligus*, sp.; *Monstrilla*, sp. r.; *Sagitta*, sp. ab. ; small Medusidæ, c.; young herrings, fr. ; young Lamellibranchs and Gastropods, f.; young Crustacea, f.; young starfish, f.	Lemon soles, .	7	11½–13	6	11	16	8–9		
					,, ,, .	1	6	...	...	...	...		
					Common dabs, .	6	8	5	6½	...	...		
					Long rough dabs,	3	10	5	8	1	6		
					Haddocks, . .	3	10½	11	9	16	8		At finish — Wind W. by N., force 6; weather and sea as before ; tide, 4½ hours flood; barometer, 29·77; transparency, 1½ fathoms.
					Cod, . . .	1	34	2	20–23	6	13–15		
					,, . .	3	12	6	10	2	8		
					Whitings, . .	1	13	9	10	5	8½		
					,, . .	1	5	...	...	...	...		
					Gurnards, . .	1	10	5	6	...	...		
					Angler, . .	1	26½	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate, Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 24th Oct. 1893. 10.50 a.m. to 1.25 p.m.	E. 50·9	50·8	50·7 6¾ fath.	Surface Tow-net. — Boreophausidæ, r.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; small Medusæ, fr.; young Crustacea, f.	Plaice,	2	19–20½	11	15	22	13	*Pecten opercularis*, ab.; *Portunus*, sp. f.; *Chalina*, sp. fr.	At beginning—Wind W.S.W., force 6; weather, overcast; sea, choppy; tide, 3½ hours flood; barometer, 30·09; transparency, 2 fathoms.
					,,	11	11	12	10	13	9		
					,,	1	7	...	...	...	...		
	W. 54·8	52·0	50·9 7 fath.	Bottom Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Caligus*, sp. f.; *Sagitta*, sp. f.; small Medusæ, f.	Lemon sole,	1	6	...	...	...	...		
					Common dabs,	2	12	1	9	1	8		
					,, ,,	2	7	...	...	...	...		
					Gurnards,	2	12	...	...	...	...		
					Angler,	1	16	...	...	...	...		
Station V. 31st Oct. 1893. 7.40 a.m. to 9.40 a.m.	W. 37·7	50·2	50·1 29 fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. fr.; small *Aurelia*, f.	Thornback rays,	1	19	1	16	...	...	*Fusus antiquus*, r.; *Loligo*, sp. f.; *Nephrops norvegicus*, ab.; *Asterias*, sp. f.; *Solaster papposa*, f.	At beginning — Wind N.W., force 4; weather, clear; sea, moderate; tide, 1¼ hours ebb; barometer, 30·08; transparency, 3½ fathoms. At finish—Wind N.N.W., force 4; weather, clear; sea, north easterly swell; tide, 3¼ hours flood; barometer, 30·12; transparency, 4¾ fathoms.
					Starry ray,	1	7	...	...	...	...		
					Plaice,	3	17½–18½	19	14–15½	33	12–13½		
					,,	2	11	...	...	...	...		
	E. 42·8	51·0	50·7 22½ fath.	Bottom Tow-net.—Boreophausidæ, f.; *Parathemisto*, sp. f.; *Atylus*, sp. c.; *Calanus finmarchicus*, f.; *Centropages*, sp. f.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Tomopteris*, sp. f.; *Pleurobrachia*, sp. f.; young Gastropods, fr.; young Crustacea, f.	Lemon soles,	2	15	3	11	1	7		
					Common dabs,	3	10	6	9	25	7		
					,, ,,	9	4½	...	...	...	...		
					Witch soles,	3	15–16½	3	12–14	1	9		
					,, ,,	1	8	...	...	...	...		
					Long rough dabs,	9	9	22	8	17	6		
					,, ,,	7	4	...	...	...	...		
					Haddocks,	129	9	298	7–8	...	...		
					Cod,	2	24–30	4	19–22	3	12		
					,,	4	7–9½	...	...	...	...		
					Whitings,	2	12	2	9	1	8		
					Gurnards,	1	15	6	13	1	7		
					,,	1	3	...	...	...	...		
					Angler,	1	29	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VI. 31st Oct. 1893. 11.5 a.m. to 12.5 p.m.	W. 45·3	50·0	49·4 15 fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. f.; *Aurelia*, sp. f.; small Medusæ, f.	Thornback ray,	1	13	...	...	...	...	*Pecten opercularis*, r.; *Asterias*, sp. f.; *Solaster endeca*, f.; *Echinus esculentus*, r.	At beginning—Wind N.N.W., force 4; weather, clear; sea, slight; tide, 4½ hours ebb; barometer, 30·11; transparency, 3½ fathoms.
					Plaice,	1	26	3	21–23½	6	18–20		
					,,	21	15–17	37	13–14½	20	10–11½		
					Lemon soles,	13	12	3	8	...	...		
	E. 46·4	50·2	50·0 14½ fath.	Bottom Tow-net—*Virbius fasciger*, r.; *Atylus*, sp. f.; *Iphimedia*, sp. r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Sagitta*, sp. f.; *Tomopteris*, sp. f.; *Pleurobrachia*, sp. f.; young Crustacea, f.	Common dabs,	25	8	18	6½	6	5		
					Brill,	1	13	...	...	...	...		
					Haddocks,	2	10	...	...	...	...		
					Cod,	3	22	2	20½	1	12		
					Gurnards,	3	10	...	...	...	...		
					Anglers,	1	18½	1	12	...	...		
Station VII. 24th Oct. 1893. 7.45 a.m. to	E. 49·6	51·6	51·4 16½ fath.	Surface Tow-net damaged.	Thornback ray,	1	14	...	...	...	...	*Cancer pagurus*, r.; *Nephrops norvegicus*, fr.; *Asterias*, sp. f.; *Solaster endeca*, fr.; *Alcyonium*, sp. f.	At beginning—Wind W.S.W., force 6; weather, cloudy; sea, moderate; tide, ½ hour flood; barometer, 30·10; transparency, 3 fathoms.
					Plaice,	5	13–14½	1	12	...	...		
					Common dabs,	1	11	2	9	15	7–8		
	W. 52·8	51·3	51·4 13 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Caligus*, sp. f.; *Sagitta*, sp. c.; young Crustacea, f.	,, ,,	8	5·6	...	...	...	...		
					Witch soles,	4	18½–19½	4	17–18	1	12		
					Long rough dabs,	9	10	8	8	5	6½		
					,, ,,	13	4½–5½	...	...	...	...		
					Haddocks,	103	9–9½	466	7½–8½	...	...		
					Cod,	1	20	1	23	3	12		At finish—Wind as before; weather, cloudy; sea, choppy; tide, 2½ hours flood; barometer, 30·10; transparency, 2 fathoms.
					,,	2	10	...	...	...	...		
					Whitings,	6	11	4	10	11	8		
					,,	10	7	...	...	...	...		
					Gurnard,	1	14	...	...	...	...		
					Angler,	1	12	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VIII. 30th Oct. 1893. 12.20 p.m. to 2.20 p.m.	S.W. 44·6	50·3	50·1 21 fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. fr.; small *Aurelia*, sp. r.	Grey skate,	1	7½	...	..	...	...	*Loligo*, sp. f.; *Nephrops norvegicus*, fr.; *Asterias*, sp. fr.; *Actinoloba*, sp. r.; *Alcyonium*, sp. f.	At beginning—Wind N. by W., force 5; weather, clear; sea, moderate; tide, ¾ hour flood; barometer, 29·88; transparency, 2¾ fathoms.
					Thornback rays,	1	17½	1	9	...	...		
					Plaice,	1	17	2	14½	...	...		
					Lemon soles,	3	13-14	3	11-12	...	...		
					Common dabs,	5	7	...	...	...	...		
	N.E. 44·0	51·0	50·9 28 fath.	Bottom Tow-net contained a large quantity of mud and sand.	Witch soles,	1	15¾	5	9	1	8		
					Long rough dabs,	7	8	8	6	4	4		
					Turbot,	1	23	...	...	...	...		
					Haddocks,	19	9½	69	8	5	7		
					Cod,	2	26-27	2	10½-12½	3	9½		
					,,	5	6-7½	...	...	...	...		
					Whiting,	1	4	...	...	...	...		
					Gurnards,	2	12	1	11	1	8		
					Hake,	1	10	...	...	...	...		
Station IX. 30th Oct. 1893. 3.0 p.m. to 5.0 p.m.	N.W. 41·3	51·3	51·2 30 fath.	Surface Tow-net.—*Parathemisto*, sp. c.; *Calanus finmarchicus*, c.; *Sagitta*, sp. c.	Starry ray,	1	9	...	...	...	...	*Loligo*, sp. r.; *Nephrops norvegicus*, ab.; *Solaster papposa*, r.	At beginning—Wind N., force 6; weather, cloudy; sea, choppy; tide, 3½ hours flood; barometer, 29·90; transparency, 4 fathoms.
					Grey skate,	1	24	...	...	...	...		
					Thornback ray,	1	14½	...	...	...	...		
	S.E. 42·2	51·2	50·7 22 fath.	Bottom Tow-net.—*Mysis*, sp. f.; *Siriella*, sp. r.; *Erythrops*, sp. f.; Boreophausidæ, f.; *Cumacca*, sp. f.; *Parathemisto*, sp. fr.; *Argissa hamatipes*, fr.; *Atylus*, sp. fr.; *Calanus finmarchicus*, c.; *Centropages*, sp. f.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Tomopteris*, sp. f.; *Pleurobrachia*, sp. f.; young Crustacea, f.	Plaice,	2	16	1	14	2	11		
					Lemon sole,	1	13	1	12	2	11		
					,, ,,	1	8	...	...	...	...		
					Common dabs,	2	7	...	...	...	...		
					Witch sole,	1	19	...	...	...	...		
					Long rough dabs,	1	11	3	10	5	8		
					,, ,,	9	6	...	...	...	...		
					Haddocks,	57	8-9	...	...	...	...		
					Cod,	1	34	1	21	2	17		
					,,	1	7	...	...	...	...		
					Whitings,	1	11	1	6½	...	...		
					Gurnard,	1	9½	...	...	...	...		
					Angler,	1	16	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 15th Nov. 1893. 11.5 a.m. to 12.55 p.m.	W. 42·9	45·3	46·0 10½ fath.	Surface Tow-net.—*Idotea marina*, r.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; small Medusæ, r.	Grey skate,	1	7	...	...	...	...	*Mytilus modiolus*, r.; *Pecten opercularis*, c.; *Nephrops norvegicus*, f.; *Eupagurus bernhardus*, f.; *Asterias*, sp. fr.; *Actinoloba dianthus*, f.	At beginning — Wind W.N.W., force 1; weather, hazy; sea, slight; tide, 4¾ hours ebb; barometer, 30·89; transparency, 2½ fathoms.
					Thornback rays,	1	21½	2	18–19	1	16½		
					,, ,,	1	13½	...	...	...	...		
					Plaice,	1	13¾	1	12½	2	11		
					Lemon soles,	1	14¾	7	11–13	1	9		
	E. 43·3	46·3	46·4 14 fath.	Bottom Tow-net.—*Macropsis slabberi*, r.; *Calisoma*, sp. r.; *Calanus finmarchicus*, fr.; *Caligus*, sp. fr.; *Sagitta*, sp. c.; *Tomopteris*, sp. c.	,, ,,	5	6½	...	...	...	...		
					Common dabs,	9	8–9	21	7	7	6		
					,, ,,	2	4½	...	...	...	...		
					Long rough dabs,	4	10	8	8	9	7		
					Haddocks,	1	16½	6	10	5	9		
					,,	2	8	...	...	...	...		
					Cod,	1	24	3	20–21	7	11–13½		
					,,	6	7–10	...	...	...	...		
					Whitings,	1	10	1	8½	...	...		
					Gurnards,	1	7	...	...	...	...		
					Anglers,	4	26–27½	2	20½–22½	1	17		
Station II. 16th Nov. 1893. 10.50 a.m. to 12.50 p.m.	W. 44·0	46·9	46·7 13½ fath.	Surface Tow-net.—*Idotea*, sp. r.; *Hyperia*, sp. r.; *Parathemisto*, sp. f.; *Hyperoche*, sp. r.; *Gamanarus*, sp. r.; *Calanus finmarchicus*, f.; *Caligus*, sp. f.; *Sagitta*, sp. f.	Thornback rays,	1	17½	1	14	...	...	*Pecten opercularis*, f.; *Asterias*, fr.; *Ophiothrix rosula*, f.; *Solaster endeca*, f.; *Solaster papposa*, r.; Zoophytes, f.	At beginning—Wind S.S.E., force 3; weather, hazy; sea, slight; tide, 3¾ hours ebb; barometer, 29·78; transparency, 3½ fathoms.
					Plaice,	6	13–14½	8	11–12½	...	...		
					Lemon soles,	2	14½	2	13	6	11		
					,, ,,	1	7	...	...	...	...		
					Common dabs,	2	8	5	7	5	6		
					Long rough dabs,	2	9	5	7	1	4½		
	E. 44·7	47·0	46·4 11½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Caligus*, sp. r.; *Sagitta*, sp. f.									At finish — Wind S.S.E., force 4; weather, hazy; sea, slight easterly swell; tide, 5¾ hours ebb; barometer, 29·72; transparency, 4½ fathoms.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.*	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
Station III. 14th Nov. 1893. 11.25 a.m. to 2.10 p.m.	E. 42·9	44·3	44·2 7 fath.	Surface Tow-net.—Boreophausidæ, r.; *Hyperia*, sp. fr.; *Sagitta*, sp. r.; *Tomopteris*, sp. r.; small *Aurelia*, sp. and other Medusids, r.	Thornback rays,	1	22	2	11	...	...	*Pecten opercularis*, ab.; *Nephrops norvegicus*, f.; *Asterias*, sp. f.; *Solaster papposa*, f.; *Echinus esculentus*, f.	At beginning—Wind W.N.W., force 2; weather, thick haze; sea, slight; tide, about low water; barometer, 29·82; transparency, 2½ fathoms. At finish—Wind N.W., force 2; weather, hazy; sea, slight; tide, 2¾ hours flood; barometer, 29·79; transparency, 2¼ fathoms.
					Plaice,	2	14	2	12½	1	11½		
					,,	1	9½	...	...	...	...		
					Lemon soles,	2	12-13	1	15	6	10-11		
					,, ,,	4	7-9	...	...	...	...		
					Common dabs,	2	9-10	1	8½	29	6-7		
					,, ,,	2	5	...	...	...	...		
	W. 46·2	45·4	46·4 8½ fath.	Bottom Tow-net.—Boreophausidæ, r.; *Calanus finmarchicus*, f.; *Caligus*, sp. fr.; *Sagitta*, sp. c.; *Tomopteris*, sp. f.; small Medusæ, f.; young Crustacea, f.	Long rough dabs,	2	12	15	9–10	19	7½		
					,, ,,	2	5	...	...	...	...		
					Haddocks,	8	9	3	8	...	...		
					Cod,	1	28½	1	14½	10	9–10		
					,,	5	6	...	...	...	...		
					Whiting,	1	7	...	...	...	...		
					Gurnard,	1	13	...	...	...	...		
					Anglers,	1	20½	1	14	...	...		
Station IV. 15th Nov. 1893. 1.40 p.m. to 4.0 p.m.	E. 44·6	45·2	45·5 8 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Caligus*, sp. f.; *Sagitta*, sp. f.; small Medusæ, f.	Plaice,	2	14–15½	21	12–13½	26	10–11½	*Pecten opercularis*, v. ab.; *Chalina*, sp. fr.	At beginning—Wind N.E., light; weather, hazy; sea, slight north-easterly swell; tide, 1½ hours flood; barometer, 29·90; transparency, 3 fathoms. At finish — Wind N.E., force 1; weather, hazy; sea, smooth; tide, 3½ hours flood; barometer, 29·91; transparency, 2 fathoms.
					,,	2	8½	...	...	...	...		
					Lemon soles,	1	11	1	10	1	5		
					Common dabs,	1	10	11	7–8	10	5–6		
					,, ,,	2	4	...	...	...	...		
	W. 42·8	45·0	44·6 6 fath.	Bottom Tow-net.—Boreophausidæ, r.; *Gammarus*, sp. r.; *Parathemisto*, sp. f.; *Idotea marina*, r.; *Calanus finmarchicus*, f.; small Medusæ, c.	Long rough dabs,	1	11	4	10	3	8		
					,, ,,	4	7	...	...	...	...		
					Cod,	1	24	1	15½	...	...		
					Anglers,	2	12	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 27th Nov. 1893. 12.45 p.m. to 2.45 p.m.	E. 44·6 W. 45·5	45·4 45·3	45·3 23½ fath. 45·3 29 fath.	Surface Tow-net.—Sea too rough for working the surface net safely. Bottom Tow-net.—*Crangon allmanni*, fr.; *Pandalus annulicornis*, r.; Boreophausidæ, fr.; *Mysis*, sp. fr.; *Erythrops gœsii*, fr.; Amphipods (*Euthemisto*, sp., *Atylus*, sp., &c.), fr.; *Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Caligus*, sp. f.; *Sagitta*, sp. ab.; young Crustacea and young Lamellibranchs, f.; *Clione borealis*, f.	Thornback rays,	1	21	1	15½	1	13½	*Nephrops norvegicus*, fr.; *Actinoloba dianthus*, f.	At beginning—Wind W., force 6; weather, hazy; sea, choppy; tide, 2½ hours flood; barometer, 29·95; transparency, 2 fathoms. At finish—Wind W. by S., force 5; weather and sea as before; tide, 4½ hours flood; barometer, 29·94; transparency, 2½ fathoms.
					Plaice,	1	13	...	...	...	...		
					Lemon soles,	1	14½	1	7½	...	...		
					Common dabs,	4	8½	5	6½	...	...		
					Witch soles,	2	17½ 18½	1	14½	1	11½		
					Long rough dabs,	6	9	6	8½	...	...		
					Haddocks,	3	12½	35	9½	121	8½		
					,,	91	7½	...	...	...	...		
					Cod,	2	27–29½	4	23½–25½	1	21½		
					,,	5	10½–12	...	...	...	...		
					Whiting,	1	14	...	...	...	...		
Station VI. 27th Nov. 1893. 3.30 p.m. to 4.25 p.m.	W. 45·6 E. 8·0	44·5 45·0	44·6 12 fath. 45·3 16½ fath.	Surface Tow-net.—Sea too rough for working the surface net safely. Bottom Tow-net.—*Crangon allmanni*, fr.; Boreophausidæ, fr.; *Mysis*, sp. and *Erythrops gœsii*, fr.; *Euthemisto*, sp. f.; *Atylus*, sp. fr.; other Amphipods, f.; *Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Centropages typicus*, r.; young Crustacea and Mollusca, f.; *Sagitta*, sp. ab.	Plaice,	8	20½ 22	8	18	26	14–16	*Fusus antiquus*, r.; *Asterias*, sp. f.; *Solaster endeca*, r.	At beginning—Wind W., force 6; weather, hazy; sea, choppy; tide, 5½ hours flood; barometer, 29·88; transparency, 2 fathoms. At finish—Wind W., force 7; weather and sea as before; tide, high water; barometer, 29·87; transparency, 2 fathoms.
					,,	5	12 13	...	...	...	...		
					Lemon soles,	4	13	4	12	...	...		
					Common dabs,	1	7	2	6	...	...		
					Long rough dabs,	1	9	1	7	...	...		
					Haddocks,	2	11	3	8	...	...		
					Cod,	4	31–33	3	29–30	2	27–28½		
					,,	5	19–21	1	15	3	10		
					,,	1	8	...	...	...	...		
					Whitings,	3	11	1	9	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VII. 21st Nov. 1893. 11.40 a.m. to 1.35 p.m.	W. 41·0	45·3	44·9 13 fath.	Surface Tow-net.—*Parathemisto*, sp. fr.; 2-spined stickleback, 1.	Grey skates,	1	22½	1	7½	1	6½	*Cancer pagurus*, r.; *Crangon*, sp.; *Pandalus*, sp. fr.; *Asterias*, sp. f.	At beginning — Wind W., force 4; weather, hazy; sea, easterly swell; tide, 5¾ hours flood; barometer, 30·35; transparency, 1½ fathoms. At finish—Wind W., force 5; weather and sea as before; tide, 1½ hours flood; barometer, 30·34; transparency, 2¼ fathoms.
	E. 42·0	46·1	46·4 24 fath.	Bottom Tow-net.—*Crangon*, sp.; *Pandalus*, sp. fr.; *Virbius*, sp. (?*fasciger*), f.; *Boreophausia*, sp. f.; *Erythrops*, sp. f.; *Mysis lamornæ*, *M. ornata*, fr.; *Chiromysis formosus*, f.; *Cumacea*, sp. f.; *Parathemisto*, sp. and other Amphipods, fr.; *Calanus finmarchicus*, f.; *Sagitta*, sp. ab.	Thornback rays,	1	10	1	8	...	...		
					Plaice,	1	13½	...	...	...	...		
					Lemon soles,	1	12½	1	11	1	7		
					Common dabs,	9	8	8	7	4	6		
					Long rough dabs,	3	9½	5	7	...	...		
					Haddocks,	1	15½	2	13	187	9–10		
					,,	91	7–8	...	...	...	...		
					Cod,	2	28½–31	2	24–27	4	21–22½		
					,,	4	13–14½	9	9–11½	8	8		
					Whitings,	1	11	3	9	2	8		
					Angler,	1	16	...	...	...	...		
					Sprat,	1	4	...	...	...	...		
					Father-lasher,	2	5½	...	...	...	...		
Station X.* (Limekilns Station). 17th Nov. 1893. 1.25 p.m. to 2.20 p.m.	W. 42·2	44·1	44·2 6½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia*, sp. fr. Bottom Tow-net.—A quantity of mud.	Grey skates,	1	12	2	9½	...	...	*Carcinus mœnas*, f.; *Eupagurus bernhardus*, f.; *Actinoloba dianthus*, f.; a quantity of mud.	At beginning—Wind W., force 7; weather, dull, showery; sea, choppy; tide, 4¾ hours ebb; barometer, 28·73; transparency, ¾ fathoms. At finish—Wind weather, sea, tide, barometer, transparency,
					Thornback rays,	1	15	1	11	1	7		
					Plaice,	1	12	...	...	...	...		
					Common dab,	1	8	...	...	...	...		
					Flounder,	1	9	...	...	...	...		
					Cod,	1	11½	4	10	2	9		
					Whitings,	1	10	1	9	2	8		

* Trawl caught on an anchor near east end of Station.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 20th Dec. 1893. 10.55 a.m. to 12.30 p.m.	E. 40·2	43·5	44·2 16 fath.	Surface Tow-net damaged.	Lemon soles, .	1	15	2	11–12	2	8½	*Pecten opercularis*, c.; *Asterias*, sp. f.; *Echinus esculentus*, fr.	At beginning — Wind W., force 5; weather, hazy; sea, moderate; tide, 5½ hours flood; barometer, 28·85; transparency, 3 fathoms. At finish—Wind W., force 3; weather, hazy; sea, slight; tide, ½ hour ebb; barometer, 28·86; transparency, 2¾ fathoms.
	W. 41·0	43·2	44·0 13½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Caligus*, sp. r.; *Sagitta*, sp. f.	Common dabs, .	1	8½	1	5½	...	...		
					Long rough dabs,	8	8	4	7	1	4½		
					Haddocks, . .	10	9	23	8	6	7		
					Cod, . . .	2	25–28½	5	20–21½	6	16–18½		
					,, . . .	6	13–15½	15	11–12	36	9–10		
					,, . . .	46	7–8	2	6	...	...		
					Whitings, . .	3	12	6	9	4	8		
					Catfish, . .	1	33	...	...	...	...		
					Herring, . .	1	5½	...	...	...	...		
Station II. 21st Dec. 1893. 11.55 a.m. to 1.35 p.m.	W. 39·5	43·0	43·1 15 fath.	Surface Tow-net.—Sea too rough to risk surface tow-net.	Thornback ray, .	1	15	...	...	...	...	*Pecten opercularis*, r.; Ascidians, f.; *Asterias*, sp. fr.; *Echinus esculentus*, fr.; *Alcyonium*, sp. f.	At beginning—Wind W. by N., force 7; weather, hazy; sea, choppy; tide, 5½ hours flood; barometer, 29·06; transparency, 2 fathoms. At finish — Wind W., force 7; weather, hazy; sea, rough; tide, 1 hour ebb; barometer, 29·07; transparency, 2½ fathoms.
	E. 39·7	43·0	42·8 14½ fath.	Bottom Tow-net. — Boreophausidæ, r.; *Calanus finmarchicus*, fr.; *Caligus*, sp. fr.; *Sagitta*, sp. c.	Starry ray, .	1	12	...	...	...	...		
					Plaice, .	1	22½	1	15½	1	14		
					Common dabs, .	1	9½	2	7	1	6		
					Long rough dabs,	1	11¼	1	8½	2	6½		
					,, ,, .	1	5	...	...	...	...		
					Haddocks, . .	2	9½	1	9	1	8		
					Cod, . . .	1	16	5	10–11½	5	8½–9½		
					,, . . .	1	5	...	...	...	...		
Station III. 26th Dec. 1893. 11.5 a.m. to 2.15 p.m.	E. 42·2	42·5	42·4 7½ fath.	Surface Tow-net.—Boreophausidæ, fr.; *Parathemisto*, sp. fr.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.	Plaice, . .	1	15	1	14	1	9	*Pecten opercularis*, fr.; *Nephrops norvegicus*, fr.; *Asterias*, sp. f.; *Ophio-*	At beginning—Wind W.S.W., force 1; weather, hazy; sea, slight; tide, ½ hour flood; bar-
					Lemon soles, .	1	14	2	10	4	9		
					,, ,, .	1	6½	...	...	...	...		
					Common dabs, .	1	7	1	6	...	...		
					Long rough dabs,	8	9	15	7–8	2	5		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.											
	Dry Bulb.	Surface.	Bottom.			No.	Inches	No.	Inches	No.	Inches		
Station III. 26th Dec. 1893. 11.5 a.m. to 2.15 p.m. —*continued.*	W. 45·5	42·4	42·9 8½ fath.	Bottom Tow-net.—Boreophausidæ, c.; *Erythrops*, sp. c.; *Mysis flexuosus*, r.; *Mysidopsis*, sp. f.; *Parathemisto*, sp. c.; *Calanus finmarchicus*, c.; *Temora longicornis*,, f.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Pleurobrachia*, sp. fr.	Haddocks, . .	22	9–10	1	8	...	...	*thrix rosula*, f.; *Solaster papposa*, r.; *Echinus esculentus*, fr.; also a small quantity of weed.	ometer, 30·19; transparency, 1½ fathoms. At finish—Wind W., force 1; weather, hazy; sea, slight; tide, 3⅝ hours flood; barometer, 30·19; transparency, 1½ fathoms.
					Cod, . . .	3	34–36	3	27–30½	7	22½–25½		
					,, . . .	8	17½–20	8	13–16	20	10–12½		
					,, . . .	29	7–8	...	...	...	...		
					Whitings, . .	5	11–12	4	8–9	4	7–8		
					Ling, . . .	1	9	...	...	...	...		
					Angler, . .	1	33	...	...	...	...		
					Catfish, . .	1	38	...	...	...	...		
					Three-bearded rockling, . .	1	11	...	...	...	...		
Station IV. 19th Dec. 1893. 10.30 a.m. to 1.55 p.m.	W. 41·0	42·4	42·8 5 fath.	Surface Tow-net.—*Sagitta*, sp. r.; *Tomopteris*, sp. r.; *Pleurobrachia*, sp. f.; water very muddy.	Plaice, . .	27	15–16½	43	13–14	132	10½–11½	*Pecten opercularis*, f.; Sponges (*Chalina*), f.; weed, c.	At beginning—Wind S.E., force 6; weather, hazy; sea, slight; tide, 5½ hours flood; barometer, 29·16; transparency, 2 fathoms. At finish—Wind S., force 7; weather, hazy; sea, choppy; tide, 2¾ hours ebb; barometer, 29·0; transparency, 2 fathoms.
					,, . .	10	7–8½	...	...	...	...		
					Common dabs, .	3	8½	3	5½	1	4½		
					Flounders, . .	1	16½	3	14–15	2	13½		
	E. 45·3	42·4	42·8 6½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Caligus*, sp. fr.; *Sagitta*, sp. fr.	,, . .	1	8½	...	...	...	...		
					Long rough dab,	1	10	...	...	...	...		
					Cod, . . .	3	16	...	...	...	...		
Station V. 28th Dec. 1893. 1.40 p.m. to 3.40 p.m.	E. 45·3	43·6	43·7 21½ fath.	Surface Tow-net. — *Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Caligus*, sp. r.; *Sagitta*, sp. f.; *Pleurobrachia*, sp. r.	Thornback rays,	1	26	1	14¾	2	13½	*Fusus antiquus*, r.; *Buccinum undatum*, r.; *Eledon cirrhosa*, r.; *Nephrops norvegicus*, fr.; *Actinoloba*, sp. f.	At beginning—Wind, variable, light; weather, hazy; sea, smooth; tide, 1 hour flood; barometer, 30·39; transparency, 2½ fathoms. At finish—Wind
					Plaice, . .	1	14¾	1	13	...	...		
					Lemon sole, .	1	12	...	...	...	...		
					Common dab, .	1	7	...	...	...	...		
					Witch soles, .	2	18	...	...	...	...		
	W. 45·1	43·4	43·3 30 fath.	Bottom Tow-net.—Euphausidæ, c.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Caligus*, sp. f.; *Sagitta*, sp. fr.	Sail-fluke, . .	1	17	...	...	..	...		
					Long rough dabs,	1	12¾	11	8–9	9	7		
					,, ,,	8	5–6	...	...	...	..		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 28th Dec. 1893. 1.40 p.m. to 3.40 p.m. —*continued.*				*marchicus*, c.; *Atylus bispinosus*, f.; *Sagitta*, sp. ab.; young herring, r.; young starfish, f.	Haddocks,	1	17	43	9½	132	8½		W.S.W., force 1; weather and sea as before; tide, 3 hours flood; barometer, 30·40; transparency, 3 fathoms.
					,,	21	7	...	...	...	...		
					Cod,	2	32–37	5	23–25	4	18		
					,,	2	13	1	11	1	9		
					,,	3	7½	...	...	...	...		
					Whitings,	1	13	1	10	4	8½		
					,,	14	4–5½	...	...	...	...		
Station VI. 29th Dec. 1893. 9.40 a.m. to 10.35 a.m.	W. 44·7	43·4	43·1 14 fath.	Surface Tow-net.—Euphausidæ, f.; *Calanus finmarchicus*, fr.; *Caligus*, sp. f.; *Sagitta*, sp. f.	Plaice,	1	23	2	19	12	15–16	*Fusus antiquus*, f.; *Buccinum undatum*, r.; *Nephrops norvegicus*, f.; *Asterias*, sp. f.	At beginning—Wind W., force 1; weather, hazy; sea, slight; tide, 2¾ hours ebb; barometer, 30·50; transparency, 3¼ fathoms. At finish — Wind, weather and sea as before; tide, 3½ hours ebb; barometer, 30·53; transparency, 3½ fathoms.
					,,	1	13	...	...	...	...		
					Lemon soles,	2	14	...	...	...	...		
					Common dabs,	2	10½	3	9	1	8		
	E. 44·7	42·5	42·9 16 fath.	Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Sagitta*, sp. f.	Long rough dabs,	2	7	...	...	...	...		
					Brill,	1	24	1	20	...	...		
					Cod,	1	36	1	34	1	24		
					,,	1	20	...	...	...	...		
Station VII. 28th Dec. 1893. 8.45 a.m. to 10.30 a.m.	W. 45·3	42·8	43·1 12 fath.	Surface Tow-net.—Euphausidæ, f.; *Parathemisto*, sp. fr.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. f.; small Medusæ, f.; young Crustacea, f.	Plaice,	1	14½	1	10	...	...	*Nephrops norvegicus*, f.; *Asterias*, sp. fr.	At beginning — Wind variable, light; weather, overcast; sea, smooth; tide, 2½ hours ebb; barometer, 30·33; transparency, 2½ fathoms. At finish—Wind W., light; weather and sea as before; tide, 4½ hours ebb; barometer, 30·38; transparency, 2¾ fathoms.
					Common dabs,	2	7½	2	6½	...	...		
					Witch soles,	1	20	1	19	...	...		
					Long rough dabs,	12	8	3	7	2	5		
			43·3 22 fath.	Bottom Tow-net.—Euphausidæ, fr.; *Erythrops*, sp. f.; *Mysis*, sp. fr.; *Gastrosaccus spinifer*, r.; *Parathemisto*, sp. fr.; *Atylus* and *Hippomedon*, sp r.; *Parathemisto*, sp. fr.; *Calanus finmarchicus*, c.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Tomopteris*, sp. fr.; small Medusæ, f.; young starfish, f.	Haddocks,	1	14⅞	38	9½	67	8		
					,,	2	7	...	...	...	...		
	E. 45·3	42·7			Cod,	2	25–26	1	21	3	15-7½		
					,,	3	11–13	2	10	2	8		
					Whitings,	2	14	7	12	8	8–10		
					,,	13	4½	...	...	...	...		
					Herrings,	1	5½	1	4½	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VIII. 27th Dec. 1893. 3.40 p.m. to 5.40 p.m.	S.E. 46·0	42·8	43·5 28 fath.	Surface Tow-net.—*Clione borealis*, r.; Euphausidæ, r.; *Parathemisto*, sp. fr.; *Calanus finmarchicus*, f.; *Sagitta*, sp. r.; young Crustacea, f.	Common dabs, .	3	7½	2	6	1	5	*Nephrops norvegicus*, f.; *Asterias*, sp. f.; *Solaster papposa*, r.	At beginning—Wind variable, light; weather, overcast; sea, slight south-easterly swell; tide, 4½ hours flood; barometer, 30·18; transparency, 4 fathoms.
					Witch soles, .	2	16	...	...	...	...		
					Long rough dabs,	1	13	1	11	10	7–8		
					,, ,, .	1	4	...	...	...	...		
					Haddocks, . .	49	10	31	8	4	7		
					Cod, . . .	2	39	1	32	4	27		
	S.W. 44·6	42·9	43·3 24 fath.	Bottom Tow-net.—*Crangon*, sp. f.; Euphausidæ, c.; *Erythrops*, sp. f.; *Mysis*, sp. c.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, c.; *Sagitta*, sp. ab.; *Tomopteris*, sp. f.	,, . .	5	22	1	15	3	11		At finish — Wind, weather, and sea as before; tide, high water; barometer, 30·19; transparency, too dark to see.
					,, . .	2	9	...	...	...	...		
					Whitings, . .	12	7½	36	6½	14	5½		
					Ling, . . .	1	21	...	...	...	...		
Station IX. 27th Dec. 1893. 1.15 p.m. to 3.10 p.m.	S.E. 47·4	43·2	43·7 30½ fath.	Surface Tow-net.—*Parathemisto*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.	Common dabs, .	1	9	1	7	...	...	*Nephrops norvegicus*, c.; 1 cuttle fish.	At beginning—Wind W.S.W., force 1; weather, cloudy; sea, slight south-easterly swell; tide, 2 hours flood; barometer, 30·19; transparency, 4 fathoms.
					Witch soles, .	1	12½	2	10¼	1	9		
					Long rough dabs,	1	11½	9	6½	1	5½		
					,, ,, .	2	4	...	...	...	...		
	N.W. 45·5	43·0	43·7 30 fath.	Bottom Tow-net. — Boreophausidæ, fr.; *Mysis*, sp. f.; *Parathemisto*, sp. fr.; *Atylus bispinosus*, fr.; *Calanus finmarchicus*, fr.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Pleurobrachia*, sp. f.	Haddocks, . .	11	10	21	8–9	7	7½		At finish — Wind S., light; weather, overcast; sea as before; tide, 4 hours flood; barometer, 30·19; transparency, 4 fathoms.
					Cod, . . .	1	33½	1	26	1	13		
					,, . .	1	8½	...	...	...	...		
					Whitings, . .	1	13	1	8½	8	6		
					,, . .	1	4	...	...	...	...		
					Angler, . .	1	35	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 12th Jan. 1893. 12.30 p.m. to 2.30 p.m.	E. 42·0	39·5	41·1 13½ fath.	Surface Tow-net.—*Boreophausia* (juv.), f.; *Parathemisto oblivia*, f.; *Calanus finmarchicus*, r.; Ctenophora, r. Bottom Tow-net. — *Thysanoessa*, sp. f.; *Gammarus*, sp. r. (juv.); *Calanus finmarchicus*, fr.; *Caligus rapax*, f.; *Sagitta*, sp. c.; Ctenophora, fr.	Plaice, . .	1	14	1	12½	...	...	*Portunus holsatus*, r.; *Asterias*, sp. r.; *Solaster endeca*, r.	At beginning—Wind N. W., force 2; weather, moderately clear; sea, north-easterly swell; tide, 2¾ hours ebb; barometer, 30·17; transparency, 3 fathoms. At finish — Wind W.N.W., force 1; weather, a slight haze; sea as before; tide, 4¾ hours ebb; barometer, 30·17; transparency, 1¾ fathoms.
	W. 44·0	38·3	39·5 8¾ fath.		Cod, . . .	1	36	1	31	1	30		
					,, . . .	1	29	...	...	..	...		
					Whitings, . .	1	6	1	5	...	...		
Station II. 12th Jan. 1893. 2.45 p.m. to 4.35 p.m.	W. 44·0	38·3	39·5 8½ fath.	Surface Tow-net. — *Parathemisto*, sp. fr.; *Calanus finmarchicus*, f.; Ctenophora, r. Bottom Tow-net. — *Thysanoessa*, sp. f.; *Calanus finmarchicus*, fr.; *Caligus rapax*, r.; *Sagitta*, sp. c.; young Ophiurids, f.	Plaice, . .	1	22	...	...	...	...		At beginning — Wind W.N.W., force 1; weather, a slight haze; sea, north-easterly swell; tide, 5 hours ebb; barometer, 30·17; transparency, 2 fathoms. At finish — Wind as before; weather, cloudy; sea as before; tide, about ½ hour flood; barometer, 30·15; transparency, 3 fathoms.
	E. 39·5	39·5	41·0 12 fath.		Cod, . . .	1	32½	2	30	1	29		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.											
	Dry Bulb.	Surface.	Bottom.			No.	Inches	No.	Inches	No.	Inches		
Station III. 13th Jan. 1893. 8.15 a.m. to 10.5 a.m.	E. 37·5	38·1	41·0 13½ fath.	Surface Tow-net.—*Thysanoessa*, sp. r.: *Atylus*, sp. r.; *Sagitta*, sp. r.; Ctenophora, r.	Common dab,	1	11½	...	...	...	...	*Portunus depuratur*, r.; *Eupagurus bernhardus*, r.; *Asterias*, sp. f.; Zoophytes and weed a small quantity.	At beginning—Wind W., force 2; weather, cloudy; sea, moderate; tide, 3¼ hours flood; barometer, 29·96; transparency, 2 fathoms. At finish — Wind as before; weather, showery; sea, slight; tide, fully 5 hours flood; barometer, 29·94; transparency, 2½ fathoms.
					Long rough dabs,	1	12	1	7¼	1	6¾		
					Cod,	1	26	1	25	1	24		
					,,	1	4	...	...	...	...		
	W. 38·4	38·4	41·0 9½ fath.	Bottom Tow-net.—*Thysanoessa*, sp. f.; *Mysis*, sp. f.; *Amathilla sabini*, 1; *Atylus*, sp. fr.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. fr.	Whitings,	1	8	1	6	1	5		
Station IV. 13th Jan. 1893. 11.30 a.m. to 2.0 p.m.	W. 41·8	37·9	39·9 7 fath.	Surface Tow-net. — *Idotea marina*, 1; *Acartia longiremis*, r.; *Sagitta*, sp. r.; Ctenophora, fr.	Plaice,	1	13	7	12	1	9	*Aterias*, sp. f.; *Flustra*, sp. and weed, f.	At beginning—Wind W., force 1; weather, cloudy, with passing showers; sea, slight; tide, fully ¼ hour ebb; barometer, 29·92; transparency, 2 fathoms. At finish—Wind N. by E., force 2; weather, moderately clear; sea, slight; tide, fully 3 hours ebb; barometer, 29·90; transparency, 1½ fathoms.
					Common dabs,	1	10	1	8	3	5		
					Cod,	1	35	...	...	...	...		
					Whitings,	7	6	6	5	3	4		
					Herrings,	1	4	2	3½	...	...		
	E. 43·5	39·2	40·1 11½ fath.	Bottom Tow-net.—*Thysanoessa*, sp. fr.; *Macropsis slabberi*, f.; *Atylus* sp. f.; *Calanus finmarchicus*, fr.; *Sagitta*, sp. fr.; Ctenophora, f.	*Liparis montagui*,	1	3	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 13th Jan. 1893. 2.25 p.m. to 4.25 p.m.	W. 40·0	39·2	41·0 14½ fath.	Surface Tow-net. — Euphausidæ, f.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, f.	Starry ray, .	1	8	...	...	..	...	*Buccinum undatum*, r.; *Asterias*, sp. f.; weed, small quantity.	At beginning — Wind N.N.E., force 2; weather, cloudy; sea, moderate; tide, 2½ hours ebb; barometer, 29·90; transparency, 2½ fathoms.
					Common dabs, .	1	10	1	7	...	...		
					Long rough dab,	1	8½	...	...	...	...		
					Turbot, . .	1	16	...	...	...	...		
					Haddock, . .	1	6	...	...	...	...		
	S. 41·7	39·3	41·3 14 fath.	Bottom Tow-net. — Euphausidæ, r.; *Parathemisto*, sp. r.; *Calanus finmarchicus*, c.; *Caligus rapax*, r.; *Sagitta*, sp. c.; Ctenophora, f.	Whiting, . .	1	7	...	...	...	...		At finish — Wind N.., force 3; weather as before; sea, choppy; tide, 5½ hours ebb; barometer, 29·92; transparency, 3 fathoms.
Station I. 7th Feb. 1893. 1.25 p.m. to 3.30 p.m.	E. 44·0	40·4	40·8 12½ fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, f.; a considerable quantity of fine mud suspended in the water.	Plaice, . .	2	16½	1	15	1	13	*Asterias*, sp. f.; very little in the net.	At beginning—Wind W., force 6; weather, cloudy; sea, choppy; tide, 1 hour flood; barometer, 29·83; transparency, 4 fathoms.
					Common dabs, .	1	12	1	9	2	8		
					Flounder, . .	1	14½	...	...	...	...		
	W. 45·8	40·2	40·6 8½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Caligus rapax*, f.; *Sagitta*, sp. fr.; fine mud in suspension in the water.									At finish.—Wind W. by S., force 4; weather, cloudy; sea, moderate; tide, 3 hours flood; barometer, 29·83; transparency, 3 fathoms.
Station II. 8th Feb. 1893. 11.0 a.m. to 1.0 p.m.	W. 44·0	40·4	40·8 8 fath.	Surface Tow-net. — *Parathemisto*, sp. r.; *Calanus finmarchicus*, f.; *Caligus rapax*, r.; *Sagitta*, sp. f.; *?Autolytus* (a small dark-reddish coloured pelagic Annelid, carrying a cluster	Starry rays, .	2	11	...	...	...	...	*Cancer pagurus*, 1; *Asterias*, sp. f.; weed and Zoophytes, f.	At beginning—Wind W. by N., force 2; weather, cloudy; sea, slight; tide, 4 hours ebb; barometer, 29·57; transparency, 3 fathoms.
					Common dab, .	1	9	...	...	...	...		
					Cod, . . .	1	29	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station II. 8th Feb. 1893. 11.0 a.m. to 1.0 p.m. —*continued.*	E. 44·0	40·2	41·0 13 fath.	of ova), r.; Ctenophora, f. Bottom Tow-net.—*Atylus*, sp. r.; *Parathemisto*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, f.									At finish — Wind W.N.W., force 4; weather, cloudy; sea, choppy; tide, about high water; barometer, 29·62; transparency, 4 fathoms.
Station III. 7th Feb. 1893. 3.50 p.m. to 5.25 p.m.	W. 45·0	40·4	40·8 8½ fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Hyperoche*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, c.	Common dab, . .	1	9	...	...	...	...	*Asterias*, sp. f.; very little in net.	At beginning—Wind W. by S., force 4; weather, cloudy; sea, moderate; tide, 3½ hours flood; barometer, 29·81; transparency, 3¼ fathoms.
					Flounder, . .	1	14½	...	...	...	...		
					Whitings, . .	2	4–5	...	...	...	...		
	E. 44·0	40·2	40·8 13 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. fr.; Ctenphora, f.; fine mud in suspension in the water.									At finish — Wind as before; weather, slight haze; sea as before; tide, 5¼ hours flood; barometer, 29·82; transparency, 2½ fathoms.
Station IV. 8th Feb. 1893. 8.15 a.m. to 10.35 a.m.	E. 40·5	40·4	40·8 8 fath.	Surface Tow-net.—Euphausidæ, r.; *Parathemisto*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. fr.; Ctenophora, r.	Starry ray, . .	1	11	...	...	...	...	*Hyas coarctatus*, r.; *Asterias rubens*, f.; Zoophytes and weed among which were numerous Amphipods (*Gam-*	At beginning—Wind W. by N., force 5; weather, cloudy; sea, choppy; tide, 1¼ hours ebb; barometer, 29·49; transparency, 3 fathoms.
					Thornback ray, .	1	9½	...	...	...	...		
					Plaice, . .	20	12–13	6	11	...	...		
					Common dabs, .	1	11½	1	9½	...	...		
					Flounders, . .	1	13	1	10	1	8		
	W. 44·0	40·2	40·8 7 fath.	Bottom Tow-net.—Euphausidæ, r.; *Parathemisto*, sp. r.; *Calanus fin-*	Whitings, . .	2	4½	...	...	...	...		At finish — Wind W. by N., force 2;

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 8th Feb. 1893. 8.15 a.m. to 10.35 a.m. —*continued.*				*marchicus*, f.; *Sagitta*, sp. fr.; Ctenophora, r.								*marus*, sp.; *Atylus*, sp.; *Amathilla*, sp. (1) and others), and a few *Idotea marina*.	weather as before; sea, slight; tide, 3¼ hours ebb; barometer, 29·56; transparency, 3¼ fathoms.
Station V. 8th Feb. 1893. 1.35 p.m. to 3.40 p.m.	S. 44·0	41·1	41·0 15 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Caligus rapax*, r.; *Sagitta*, sp. f.; ? *Autolytus* (a small dark-reddish coloured pelagic Annelid), r.	Starry ray, .	1	10½	...	...	...	...	*Asterias*, sp. f.; *Alcyonium*, sp. r.; Zoophytes and weed, f.	At beginning—Wind W.N.W., force 4; weather, cloudy; sea, choppy; tide, ½ hour flood; barometer, 29·59; transparency, 4 fathoms.
					Plaice, . .	1	11	...	...	...	...		
					Common dabs, .	2	9	1	8	1	7		
					,, ,, .	1	5½	...	...	...	...		
					Long rough dabs,	1	8½	1	7½	...	...		
	N. 44·0	40·1	41·0 14 fath.	Bottom Tow-net.—*Idotea marina*, r.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, f.									At finish — Wind W.N.W., force 3; weather, moderately clear; sea, slight; tide, 2½ hours flood; barometer, 29·59; transparency, 2¾ fathoms.
Station I. 8th March 1893. 7.30 a.m. to 9.30 a.m.	W. 45·6	40·4	40·6 7¼ fath.		Thornback ray, .	1	13	...	...	...	...		At beginning — Wind W. by N., force 3; weather, clear; sea, smooth; tide, 1¼ hours ebb; barometer, 30·14; transparency, 2¾ fathoms.
					Plaice, . .	1	17	1	15	12	11–14		
					,, . .	13	7–10	...	...	...	...		
	E. 45·5	40·1	40·4 13 fath.		Common dabs, .	1	13	3	9	15	6–7		
					,, ,, .	1	4	...	...	...	...		
					Flounders, .	2	16	2	8	1	6		
					Long rough dabs,	1	7	...	...	...	...		
					Catfish, . .	1	17	...	...	...	...		At finish — Wind W., force 3; weather, cloudy; sea, slight; tide, 3¾ hours ebb; barometer, 30·16; transparency, 3¼ fathoms.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.											
	Dry Bulb.	Surface.	Bottom.			No.	Inches	No.	Inches	No.	Inches		
Station II. 9th March 1893. 8.20 a.m. to 10.15 a.m.	W. 46·7	40·6	40·6 9¾ fath.		Plaice, . .	2	12	3	9	...	...		At beginning—Wind S.W., force 4; weather, cloudy; sea, slight; tide, 2½ hours ebb; barometer, 29·87; transparency, 2¾ fathoms. At finish — Wind S.W.S., force 5; weather as before; sea, choppy; tide, 4¼ hours ebb; barometer, 29·84; transparency, 3½ fathoms.
	E. 47·8	40·4	40·2 14½ fath.		Flounders, . .	1	10	2	9	...	...		
Station III. 8th March 1893. 4.30 p.m. to 6.15 p.m.	W. 47·1	40·8	40·6 10 fath.		Plaice, . .	3	13	9	11	7	10		At beginning—Wind W.S.W., force 2; weather, slight haze; sea, slight north-easterly swell; tide, 4½ hours flood; barometer, 30·12; transparency, 2½ fathoms. At finish—Wind W., force 3; weather and sea as before; tide, about high water; barometer, 30·12; transparency, 2½ fathoms.
					,, . .	7	8	...	...	...	...		
					Common dabs, .	1	12	2	10	4	8		
	E. 45·3	40·6	40·6 12 fath.		Flounders, .	1	10	1	9	...	...		
					Father-lasher, .	1	8	...	...	...	...		
Station IV. 8th March 1893. 12.40 p.m. to 3.15 p.m.	E. 47·6	40·6	40·4 7½ fath.		Plaice, . .	1	26	90	12–13	218	9–11		At beginning — Wind W. by N., force 0; weather, slight haze; sea, slight; tide, ½ hour flood; barometer, 30·14;
					,, . .	28	5–7	...	...	...	...		
					Common dabs, .	1	13	3	8	5	8		
					Flounders, .	1	15	1	13	4	9–10		
					,, . .	1	7	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 8th March 1893. 12.40 p.m. to 3.15 p.m. —*continued.*	W. 46·0	40·8	40·4 7 fath.										transparency, 2½ fathoms. At finish — Wind W. by S., force 4; weather, cloudy; sea as before; tide, 3½ hours flood; barometer, 30·12; transparency, 2½ fathoms.
Station V. 8th March 1893. 10.0 a.m. to noon.	S. 43·8	40·1	40·2 16 fath.		Starry ray, .	1	11	...	...	...	...		At beginning—Wind W. by S., force 3; weather, hazy; sea, slight; tide, 4½ hours ebb; barometer, 30·16; transparency, 3½ fathoms. At finish — Wind W., force 2; weather, slight haze; sea, slight; tide, about low water; barometer, 30·16; transparency, 3½ fathoms.
					Plaice, . .	2	10	1	9	...	...		
					Common dabs	2	10	10	7	1	6		
	N. 47·6	40·4	40·4 14 fath.		Flounders, .	1	16	2	14	2	10		
					,, .	2	7	...	...	...	...		
					Long rough	1	8	1	6	...	...		
					Haddock,	1	7	...	...	...	...		
Station I. 8th June 1893. 3.15 p.m. to 5.15 p.m.	E. 55·0	52·8	49·3 11 fath.	Surface Tow-net.—Very little in either surface or bottom tow-nets.	Thornback rays, .	2	19	...	...	...	...	*Corystes*, sp. r.; *Portunus holsatus*, r.; *Eupagurus*, sp. r.; *Asterias rubens*, c.;	At beginning—Wind E. by N., force 1; weather, hazy; sea, slight; tide, ¼ hour flood; barometer, 30·42; transparency, 4½ fathoms.
					Plaice, .	10	12–15	22	9–11	34	6–8		
					Lemon sole, .	1	12	...	...	...	...		
	W. 53·2	55·1	54·2 6 fath.		Common dabs, .	2	10–11	41	7–8	53	5–6		
					Flounder, . .	1	10	...	...	. .	...		
					Turbot, . .	1	17	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 8th June 1893. 3.15 p.m. to 5.15 p.m. —*continued.*					Haddocks, . .	1	11	17	7–9	...	...	*Hyas araneus*, r.; *Amphidotus cordatus*, f.; *Buccinum*, spawn.	At finish — Wind E., force 1; weather and sea as before; tide, 2¼ hours flood; barometer, 30·40; transparency, 4 fathoms.
					Whitings, . .	1	11	1	9	...	...		
					Gurnards, . .	2	13	16	9–11	84	5–7		
Station II. 9th June 1893. 12.10 p.m. to 2.15 p.m.	E. 56·3	53·0	48·0 13 fath.	Surface Tow-net.—*Acartia longiremis*, fr.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Evadne* and *Podon*, sp. fr., Infusoria, c.; young fish, r.; fish ova, f.	Grey skate, .	1	19	...	...	...	...	*Portunus holsatus*, f.; Ascidians, f.; *Asterias rubens*, fr.; *Flustra*, sp. r.	At beginning — Wind E., force 1; weather, hazy; sea, slight; tide, 2¼ hours ebb; barometer, 30·38; transparency, 4¾ fathoms.
					Starry ray, .	1	6	...	...	...	...		
					Plaice, . .	1	15	62	10–12	33	7–9		
					Lemon soles, .	1	10	...	...	...	...		
					Common dabs, .	1	10	6	7–8	26	5–6		
	W. 58·1	55·0	48·7 8 fath.	Bottom Tow-net.—*Calanus finmarchicus*, r.; *Temora longicornis*, c.; *Acartia longiremis*, fr.; small Medusidæ, fr.; young *Balani*, ab.; young Annelids, f.; young Decapods, f.	Haddocks, . .	1	11	1	10	84	6–8		At finish — Wind E.S.E., force 2; weather and sea as before; tide, 4½ hours ebb; barometer, 30·38; transparency, 5¼ fathoms.
					Whitings, . .	1	10	1	8	1	6		
					Gurnards, . .	5	12–13	93	5½–8	1	3½		
					Dragonets, . .	2	8	1	7	...	...		
Station III. 9th June 1893. 10.0 a.m. to 11.40 a.m.	W. 52·3	53·9	48·8 10 fath.	Surface Tow-net.—*Acartia longiremis*, fr.; *Anomalocera pattersoni*, f.; *Evadne*, sp.; *Podon*, sp. fr.; young Decapod, f.; Infusoria, c.; young fish, f.; fish ova, f.	Grey skates, .	2	21	2	16	...	...	*Portunus holsatus*, f.; *Corystes cassivelaunus*, r.; *Asterias rubens*, fr.; a considerable quantity of seaweed.	At beginning—Wind E., force 0; weather, hazy; sea, smooth; tide, ½ hour ebb; barometer, 30·38; transparency, 5 fathoms.
					Plaice, . .	18	13–14	82	10–12	80	6–9		
					Common dabs, .	1	11	6	8-9	2	5½–7		
					Flounders, . .	2	7	...	...	...	...		
					Long rough dabs,	2	11	3	9	4	8		
	E. 53·9	52·0	47·0 13 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, f.; *Temora longicornis*, c.; *Parapontella brevicornis*, r.; *Sagitta*, sp. f.; small Medusidæ, f.; young Annelids, and young Decapods, f.; young *Balani*, ab.	Turbot, . .	1	13	...	...	...	...		At finish—Wind E., force 1; weather and sea as before; tide, 1¾ hours ebb; barometer, 30·39; transparency, 4 fathoms.
					Haddocks, . .	1	12	1	10	12	6½–8		
					Whiting, . .	1	8	...	...	...	...		
					Gurnards, . .	2	12	3	9–10	27	6–8		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 9th June 1893. 7.5 a.m. to 9.30 a.m.	N.E. 48·9	52·0	47·8 7½ fath.	Surface Tow-net.—*Acartia longiremis*, fr.; *Temora longicornis*, f.; *Centropages*, sp. fr.; *Evadne*, sp. fr.; young Decapods, f.; Infusoria, c.	Thornback rays,	2	24	1	13	...	...	*Portunus holsatus*, f.; *Asterias rubens*, f.; weed, a considerable quantity.	At beginning—Wind E., force 1; weather, hazy; sea, smooth; tide, 3¾ hours flood; barometer, 29·38; transparency, 4½ fathoms.
					Plaice,	28	12–14	101	8–10	147	5½–7		
					Lemon soles,	1	9	...	...	...	...		
					Common dabs,	12	10–11	18	8–9	149	5–7		
					Flounders,	1	10	4	7	3	6		
					Haddocks,	1	12	2	10	53	6–8		
	S.W. 53·4	54·5	49·0 7 fath.	Bottom Tow-net.—*Acartia*, sp.; *Temora*, sp. f.; small Medusidæ, f.; young Decapods, f.; young *Balani*, c.	Whitings,	1	10	1	9	1	8		At finish — Wind E., force 0; weather and sea as before; tide, near high water; barometer, 30·38; transparency, 5 fathoms.
					Gurnards,	1	18	14	10–12	10	5½–7		
					Angler,	1	8	...	...	...	...		
Station V. 8th June 1893. 12.35 p.m. to 2.40 p.m.	N. 53·9	53·2	46·5 14 fath.	Surface Tow-net.—*Acartia longiremis*, f.; *Anomalocera pattersoni*, f.; *Idotea marina*, r.; *Evadne*, sp. fr.; *Podon*, f.; fish ova, f.; a quantity of weed.	Starry rays,	1	11	1	9	...	...		At beginning—Wind E., force 1; weather, hazy; sea, slight; tide, 4 hours ebb; barometer, 30·45; transparency, 5 fathoms.
					Plaice,	1	17	4	12–13	2	9–10		
					Lemon soles,	1	13	2	9–10	2	7		
					Common dabs,	3	9–11	8	8	23	4–6		
					Flounders,	9	8	4	7	1	5		
	S. 53·4	53·4	47·0 15½ fath.	Bottom Tow-net. — *Calanus finmarchicus*, f.; *Acartia longiremis*, fr.; *Temora longicornis*, f.; *Evadne*, sp.; *Podon*, sp. fr.; *Sagitta*, sp. f.; *Appendicularia*, sp. r.; young Decapods and Cirripedes, fr.; young starfish, f.	Long rough dabs,	2	8	1	7	...	...		At finish — Wind as before; weather, strong haze; sea, slight; tide, about low water; barometer, 30·42; transparency, 4½ fathoms.
					Haddocks,	6	7	...	...	...	...		
					Whiting,	1	9	...	...	...	...		
					Gurnards,	3	10–12	10	8	53	5½–7		
					Dragonets,	2	8	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.											
	Dry Bulb.	Surface.	Bottom.			No.	Inches	No.	Inches	No.	Inches		
Station VI. 7th June 1893. 1.10 p.m. to 3.15 p.m.	S.W. 58·6	54·0	46·2 24 fath.	Surface Tow-net.—*Anomalocera pattersoni*, c.; young Decapod Crustacea, c.; *Sagitta*, sp. fr.; fish ova, f.; young fish, f.	Grey skates, .	1	15½	1	8¼	...	...	Ascidians, f.; *Asterias rubens*, ab.; *Solaster papposa*, *S. endeca*, f.; *Actinoloba*, sp. r.; *Alcyonium*, sp. fr.; *Flustra*, sp. f.	At beginning—Wind E., force 1; weather, slight haze, fine; sea, slight; tide, 5¾ hours ebb; barometer, 30·34; transparency, 6 fathoms. At finish—Wind E., force 1; weather, fog; sea, slight; tide, 1½ hours flood; barometer, 30·33; transparency, 6¾ fathoms.
					Starry rays, .	3	11½–12½	3	8–9	1	5¼		
					Sandy ray, .	1	7¾	...	...	...			
					Plaice, . .	1	14½	1	12½	...			
					Lemon soles, .	1	15½	1	13	2	10½–11¾		
	N.E. 55·4	54·0	45·0 20 fath.	Bottom Tow-net.—*Calanus finmarchicus*, r.; *Temora longicornis*, f.; *Acartia longiremis*, f.; *Centropages*, sp. f.; *Sagitta*, sp. f.; young Decapods and Cirripedes, f.; young starfish, f.	Common dabs, .	12	7–8	39	5–6½	...	...		
					Long rough dabs,	1	8¾	4	7	2	6		
					Haddocks, . .	2	12	1	10	2	6½–7½		
					Whiting, . .	1	9¾	...	...	...	...		
					Gurnards, . .	1	11	8	9	2	8		
					Hake, . .	1	12	...	...	...	...		
					Dragonet, . .	1	9	...	...	...	...		
Station I. 5th July 1893. to 9.45 a.m. 11.50 a.m.	E. 54·1	54·1	52·1 13 fath.		Thornback ray, .	1	9	...	...	...	...	*Portunus holsatus*, f.; *Asterias*, sp. f.; *Ophiura albida*, f.; *Aphrodite*, sp. r.; small Medusidæ, c.; young Cephalopods, fr.	At beginning—Wind E.N.E., force 2; weather, hazy; sea, slight; tide, 3 hours ebb; barometer, 30·07; transparency, 5 fathoms. At finish—Wind, weather, and sea as before; tide, 5½ hours ebb; barometer, 30·08; transparency, 3 fathoms.
					Plaice, . .	1	15½	5	12–13	24	10–12		
					„ . .	26	8–9	14	7–6	...	...		
					Flounder, . .	1	9	...	...	...	...		
					Long rough dab,	1	6¾	...	...	...	...		
					Haddocks, . .	3	9	12	8–7	...	...		
					Cod. . . .	8	9–10	13	8–8½	20	7–6		
					„ . .	5	5–4	1	3	...	...		
					Whitings, . .	3	7	5	5–6	...	...		
					Gurnards, . .	5	13–14	2	10	1	8		
					„ . .	11	5½–6½	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station II. 7th July 1893. 2.50 p.m. to 4.50 p.m.	W. 59·0	57·1	53·2 7½ fath.	Surface Tow-net.—*Temora longicornis*, f.; *Acartia*, sp. f.; *Anomalocera patterson*i, f.; young Crustacea, f.; young fish, r.; fish ova, f.	Thornback ray, .	1	27	...	...	...	...	*Octopus vulgaris*, r.; *Portunus holsatus*, fr.; *Asterias*, sp. fr.; a large quantity of weed.	At beginning—Wind S.E., force 3; weather, slight haze; sea, easterly swell; tide, ½ hour flood; barometer, 29·88; transparency, 4 fathoms. At finish—Wind S.E., force 3; weather and sea as before; tide, 2½ hours flood; barometer, 29·86; transparency, 6 fathoms.
					Plaice, . .	2	14	30	11–12	51	9–10		
					,, . .	57	7½–8	19	7–5½	...	...		
					Common dabs, .	2	11–12	4	9–10	13	7–8		
					,, ,, .	5	6	...	...	...	...		
					Flounder, . .	1	6½	...	...	...	...		
	S. 60·6	56·0	52·1 13 fath.		Long rough dabs,	1	9	1	8	...	...		
					Haddocks, . .	13	8–9	5	7½–8	...	...		
					Whitings, . .	1	6	1	5	...	...		
					Gurnards, . .	2	14	5	12–13	2	11		
					,, . .	5	8–9½	...	...	...	...		
Station III. 5th July 1893. 2.55 p.m. to 4.40 p.m.	W. 55·4	56·0	53·0 8 fath.	Surface Tow-net.—*Acartia*, sp. f.; *Anomalocera patterson*i, f.; young Decapoda, f.; young *Motella mustela*, r.	Plaice, . .	1	14	21	12	39	9½	*Cancer pagurus*, r.; *Portunus holsatus*, fr.; *Asterias*, sp. f.; a large quantity of weed.	At beginning—Wind E. by N., force 2; weather, hazy; sea, slight; tide, 1½ hours flood; barometer, 30·08; transparency, 4 fathoms. At finish — Wind E., force 2; weather and sea as before; tide, 3¼ hours flood; barometer, 30·08; transparency, 4½ fathoms.
					,, . .	64	7–8	93	6½–5½	...	...		
					Common dabs, .	3	10	8	8	9	7		
					,, ,, .	15	5½–6	...	...	...	...		
	E. 54·8	54·4	51·9 13 fath.	Bottom Tow-net. — *Temora longicornis*, fr.; *Acartia*, sp. fr.; *Podon*, sp. f.; young Annelids and young Actinidæ, fr.; young Crustacea, f. (chiefly Decapods).	Flounder, . .	1	9½	...	...	...	...		
					Long rough dabs,	3	9½	2	8½	1	7		
					Haddocks, . .	44	8½	39	7½	...	...		
					Whiting, . .	1	6½	...	...	...	...		
					Gurnards, . .	2	13	2	10	1	8		
					Angler, . .	1	16	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 7th July 1893. 9.0 a.m. to 11.45 a.m.	N.E. 55·4	54·3	53·4 8½ fath.		Thornback rays,	1	20	1	19	1	13	*Portunus* (*holsatus* chiefly), fr.; *Asterias*, sp. f.; a considerable quantity of weed.	At beginning — Wind E.S.E., force 1; weather, hazy; sea, easterly swell; tide, 1 hour ebb; barometer, 29·93; transparency, 3½ fathoms. At finish — Wind E., force 1; weather and sea as before; tide, 5½ hours flood; barometer, 29·93; transparency, 3 fathoms.
					Plaice, . .	17	12–13	37	9–10	84	7–8		
					,, . .	79	5½–6½	...	...	...	...		
					Lemon sole, .	1	6	...	...	...	...		
	S.W. 60·8	57·0	55·4 5½ fath.		Common dabs, .	12	10	18	8–9	92	6–7		
					,, ,, .	37	3½–5	...	...	...	...		
					Flounders, . .	1	9½	2	7½	1	6½		
					Haddocks, . .	66	8–9	49	6½–8	...	...		
					Whiting, . .	1	6	...	...	...	...		
					Gurnards, . .	1	14	4	13	4	10		
					,, . .	3	7	...	...	...	...		
Station V. 5th July 1893. 7.10 a.m. to 9.10 a.m.	N. 52·5	54·9	51·4 16 fath.	Surface Tow-net. — *Temora longicornis*, f.; *Acartia*, sp. f.; *Aurelia aurita*, f.; small Medusidæ, f.; young Crustaceans, f. Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.; very little in either of the Tow-nets.	Plaice, .	1	14	3	11–12	5	10	Ascidians, f.; *Corystes cassivelaunus*, f.; *Asterias*, sp. f.; *Alcyonium*, sp. f.; *Aurelia aurita*, f.; Zoophytes, f.	At beginning—Wind E., force 2; weather, hazy; sea, slight; tide, ½ hour ebb; barometer, 30·05; transparency, 7½ fathoms. At finish — Wind E.N.E., force 2; weather and sea as before; tide, 2½ hours ebb; barometer, 30·07; transparency, 5 fathoms.
					,, .	6	9	...	...	...	...		
					Lemon soles, .	1	12	1	9	...	...		
					Common dabs, .	5	9–10	18	7–8	24	5–6		
					,, ,, .	1	4	...	...	...	...		
	S. 54·1	54·9	50·3 17½ fath.		Flounders, .	3	7	1	6	...	...		
					Long rough dabs,	1	9	1	7	...	...		
					Haddocks, .	1	12	1	8	2	7		
					Whitings, . .	1	10	1	9		7–		
					,, . .	1	5½	...	...	...	...		
					Gurnards, . .	2	10	6	8–9	17	5½ 6		
					,, . .	1	4	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station. Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VI. 4th July 1893. 2.40 p.m. to 4.45 p.m.	S. 55·2	53·0	50·5 24 fath.	Surface Tow-net. — *Calanus finmarchicus*, f.; *Aurelia aurita*, r.; small Medusidæ, f.	Grey skates,	1	23	2	19–20	2	16–17	*Octopus vulgaris* (half-grown); *Fusus antiquus*, f.; *Nephrops norvegicus*, f.; *Eupagurus bernhardus*, f.; *Asterias*, sp. fr.; *Alcyonium*, sp. fr.; *Pleurophyllidia loveni*, sp.	At beginning — Wind E., force 2; weather, hazy; sea, slight; tide, 3½ hours flood; barometer, 30·10; transparency, 4½ fathoms.
	N. 53·9	53·5	50·0 24 fath.	Bottom Tow-net.—Young *Atylus*, sp. f.; *Calanus finmarchicus*, f.; *Temora longicornis*, fr.; *Sagitta*, sp. c.	Starry rays,	1	10	1	6	...	...		
					Sandy ray,	1	8	...	...	...	...		
					Plaice,	2	13	5	11	2	10		
					Lemon soles,	1	14	1	12	1	11		
					,, ,,	1	10	...	...	...	...		
					Common dabs,	1	9	30	8	31	6		
					,, ,,	20	5	...	...	...	...		
					Flounders,	1	7	1	8	...	...		
					Long rough dabs,	1	13	28	7–8	3	6		
					Haddocks,	1	12	2	10	14	7–8		
					,,	2	6	...	...	...	...		
					Whitings,	1	11	1	10	1	5		
					Gurnards,	2	14	5	10	17	7–8		
					,,	2	5	...	...	...	...		
					Angler,	1	15	...	...	...	...		
Station I. 8th Nov. 1893. 11.15 a.m. to 1.30 p.m.	W. 46·2	45·5	46·9 7½ fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; small Medusæ, fr.; young Crustacea, f.	Starry ray,	1	13	...	...	...	...		At beginning—Wind N.E., force 5; weather, cloudy; sea, north-easterly swell; tide, 2¾ hours flood; barometer, 30·40; transparency, 2½ fathoms. At finish — Wind N.E., force 6; weather and sea as before; tide, 5 hours flood; barometer, 30·39; transparency, 3 fathoms.
					Plaice,	2	12–13½	2	10–11	1	9½		
					Common dabs,	2	8–9	5	7	6	6		
					,, ,,	2	4½	...	...	...	...		
	S.E. 48·9	46·8	47·6 13 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Caligus*, sp. f.; *Sagitta*, sp. fr.; *Tomopteris*, sp. f.; Medusæ (small), fr.; young Crustacea, f.	Haddocks,	58	9–10	...	...	...	...		
					Cod,	2	33–34	2	24–27	2	22–23½		
					,,	2	8½–9½	...	...	...	...		
					Whitings,	1	12	1	10	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl Down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.				No.	Inches	No.	Inches	No.	Inches		
	Dry Bulb.	Surface.	Bottom.										
Station II. 9th Nov. 1893. 10.55 a.m. to 12.55 p.m.	W. 43·3	46·4	46·4 9 fath.	Surface Tow-net.—*Paramphithemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; small Medusæ, fr.; young Crustacea, f.	Plaice, . .	1	13	...	...	...	...		At beginning—Wind N.E., force 5; weather, cloudy; sea, choppy; tide, 2 hours flood; barometer, 30·48; transparency, 2½ fathoms.
					Lemon sole, .	1	8	...	...	...	...		
					Common dabs, .	1	9	5	7–8	8	6		
					Long rough dabs,	2	7	...	...	...	...		
					Haddocks, . .	39	9½-10½	44	8–9	...	...		
	E. 46·0	47·1	47·8 14 fath.	Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Tomopteris*, sp. fr.; young Crustacea, fr.	Cod, . . .	1	10	1	9	...	...		At finish — Wind E.N.E., force 6; weather, overcast; sea, choppy; tide, 4 hours flood; barometer, 30·45; transparency, 2½ fathoms.
					Whitings, . .	2	13	...	...	...	...		
					Angler, . .	1	16½	...	...	...	...		
Station III. 9th Nov. 1893. 8.30 a.m. to 10.40 a.m.	E. 41·5	46·3	46·9 12 fath.	Surface Tow-net.—*Paramphithemisto*, sp. fr.; *Calanus finmarchicus*, f.; *Caligus*, sp. f.; *Sagitta*, sp. f.; small Medusæ, fr.; young Crustacea, f.	Starry rays, .	1	11½	1	9	...	...		At beginning—Wind N.N.E., force 5; weather, overcast; sea, choppy; tide, 5½ hours ebb; barometer, 30·48; transparency, 2½ fathoms.
					Common dabs, .	2	7	2	5	...	...		
					Long rough dabs,	2	8½	1	7	...	...		
					Haddocks, . .	12	10	7	9	...	...		
					Cod, . . .	2	40	2	31–36	2	27		
					,, . . .	2	20–24	1	9½	...	...		
	W. 43·5	56·1	46·4 8½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Caligus*, sp. f.; *Sagitta*, sp. c.; *Tomopteris*, sp. fr.; young Crustacea, fr.									At finish — Wind N.E., force 6; weather, cloudy; sea, choppy; tide, 1½ hours flood; barometer, 30·48; transparency, 2½ fathoms.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IV. 8th Nov. 1893. 8.5 a.m. to 10.35 a.m.	E. 41·3	45·4	47·3 7 fath.	Surface Tow-net.—*Hyperiidæ* f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; small Medusæ, fr.; young Crustacea, f.	Plaice,	4	14–15	16	12–13½	10	10–11		At beginning — Wind N.E., force 2; weather, cloudy; sea, north-easterly swell; tide, 5½ hours ebb; barometer, 30·38; transparency, 1½ fathoms. At finish—Wind N.W., force 1; weather and sea as before; tide, 2 hours flood; barometer, 30·39; transparency, 2½ fathoms.
					,,	3	9	...	...	...	...		
					Common dabs,	5	10	7	7–8	4	5		
					,, ,,	1	3½	...	...	...	...		
					Flounder	1	11	...	...	...	...		
	W. 46·0	44·8	45·1 7½ fath.	Bottom Tow-net.—*Gastrosaccus spinifer*, r.; *Cuma*, sp. r.; *Atylus*, sp. r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. fr.; *Tomopteris*, sp. f.; small Medusæ, f.	Long rough dab,	1	9	...	...	...	...		
					Haddocks,	1	24	2	10	3	8		
					Cod,	1	39½	3	35–36	2	30½–32½		
					,,	1	23½	2	12	2	8½		
					Whitings,	2	13	11	8–9	10	5½		
					,,	11	4	...	...	...	...		
					Pogge,	1	3½	...	...	...	...		
Station V. 8th Nov. 1893. 2.5 p.m. to 4.5 p.m.	S. 43·5	46·9	48·0 11 fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; small Medusæ, fr.; young Crustacea, f.	Plaice,	3	12–13	1	10	...	...		At beginning—Wind N.E., force 6; weather, cloudy; sea, choppy, north-easterly swell; tide, 5½ hours flood; barometer, 30·39; transparency, 3 fathoms. At finish — Wind, weather and sea as before; tide, 1½ hours ebb; barometer, 30·39; transparency, 2½ fathoms.
					Common dabs,	3	9–10½	3	6	1	4		
					Long rough dab,	1	7	...	...	...	...		
					Haddocks,	35	9–10	216	8–9	...	...		
	N. 43·5	47·0	47·3 15 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. fr.; *Tomopteris*, sp. f.; small Medusæ, fr.; young Crustacea, f.	Cod,	1	13	3	9	1	8		
					Whiting,	1	16	...	...	...	...		
					Herring,	1	6	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—III. Montrose.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 14th Jan. 1893. 9.55 a.m. to 11.50 a.m.	E. 32·0	40·6	41·0 18½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. fr.; Ctenophora, f. Bottom Tow-net.—*Crangon allmanni*, r.; Euphausidæ, f.; *Mysis spiritus*, ab.; *Mysis*, sp. f.; *Erythrops*, sp. r.; *Hyperoche*, sp.; *Atylus*, sp., and other Amphipods f.; *Calanus finmarchicus*, fr.; *Caligus rapax*, f.; *Sagitta*, sp. c.; Ctenophora, fr.	Plaice,	2	14½	...	...	...	...	*Asterias*, sp. f.; *Alcyonium*, sp. fr.	At beginning—Wind E.N.E., force 5; weather, snow shower; sea, rough; tide, 3¾ hours flood; barometer, 29·70; transparency, 4½ fathoms. At finish — Wind W.N.W., force 4; weather and sea as before; tide, near high water; barometer, 29·74; transparency, 1½ fathoms.
	W. 34·0	39·0	39·2 6 fath.		Lemon sole,	1	12½	...	...	...	...		
					Common dabs,	1	12	1	7½	...	...		
					Long rough dabs,	1	11	1	10½	1	7¼		
					Haddocks,	1	12	1	7	...	...		
					Cod,	4	29	4	27–28	8	24–26		
					,,	2	7½–15½	...	...	...	...		
					Whitings,	1	6	1	5	...	...		
Station II. 14th Jan. 1893. 8.5 a.m. to 9.10 a.m.	W. 30·5	39·3	39·9 5½ fath.	Surface Tow-net. — Euphausidæ, r.; *Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Ctenophora, fr. Bottom Tow-net. — Euphausidæ, f.; *Mysis spiritus*, ab.; *Mysis*, sp. f.; *Hyperoche*, sp.; *Atylus*, sp., and other Amphipods, f.; *Calanus finmarchicus*, f.; *Monstrilla*, sp., one; *Sagitta*, sp. c.	Haddock,	1	25	...	...	...	...	*Asterias*, sp. f.; small quantity of weed.	At beginning—Wind N. by E., force 4; weather, snow shower; sea, north-easterly swell; tide, 2 hours flood; barometer, 29·71; transparency, 1 fathom. At finish—Wind N., force 4; weather and sea as before; tide, 3 hours flood; barometer, 29·71; transparency, 2½ fathoms.
	E. 30·5	39·7	40·8 14 fath.		Cod,	2	28	1	21	2	20		
					Whitings,	2	6½	4	5½	...	...		
Station I. 13th Feb. 1893. 5.13 p.m. to 7.0 p.m.	N.E. 37·4	39·7	40·8 17 fath.	Surface Tow-net. — Bottle with tow-net gathering washed overboard. Bottom Tow-net.—Net had touched bottom, and contained specimens of *Telene*,	Grey skate,	1	17	...	...	...	...	*Cancer pagurus*, r.; *Portunus holsatus*, sp. fr.; *Eupagurus bernhardus*,	At beginning—Wind S.E. by S., force 4; weather, hazy; sea, south-easterly swell; tide,
					Starry rays,	1	11	1	10	...	...		
					Plaice,	1	9	...	...	...	...		
					Long rough dabs,	1	12½	1	8	2	7		
					Cod,	1	31	1	27	2	23–24		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—III. Montrose—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 13th Feb. 1893. 5.15 p.m. to 7.0 p.m. —*continued.*	S.W. 36·3	39·5	40·2 7 fath.	*Nucula*, *Mactra*, *Philine*, *Nassa*, *Portunus*, *Porcellana*, *Crangon*, *Pandalus*, Amphipods, *Diastylus*, *Ophiura*, *Ophiothrix*; *Aphrodita*, and other Annelids, *Ascidia*, young long rough dabs, young sand eel, young pogge, a quantity of sand and broken shells.	Cod, . .	2	11–13	...	...	...	...	f.; *Asterias*, sp. fr.; *Alcyonium*, sp. f.; Zoophytes (*Flustra*, &c.), f.	5½ hours ebb; barometer, 29·40; transparency, 3 fathoms. At finish—Wind S.E., force 5; weather, rain; sea, rough; tide, 1 hour flood; barometer, 29·39; transparency,
					Whitings, . .	3	6	...	...	...	...		
Station II. 13th Feb. 1893. 3.25 p.m. to 4.30 p.m.	W. 39·3	40·4	40·8 5¼ fath.	Surface Tow-net.—*Parathemisto*, sp. f.; *Sagitta*, sp. fr.; Ctenophora, f. Bottom Tow-net.—Euphausidæ, f.; *Sagitta*, sp. ab.	Grey skates, .	1	13½	2	11	...	...	*Buccinum undatum* (1); *Cancer pagurus*, (1); *Portunus holsatus*, r.; *Eupagurus bernhardus*, r.; *Asterias*, sp. f.; *Aphrodita*, sp. r.; Actiniadæ, r.; Zoophytes, weed, f.; *Ascidia*, f.	At beginning—Wind S.E., force 2; weather, slight haze; sea, slight south-easterly swell; tide, 3¼ hours ebb; barometer, 29·43; transparency, 1½ fathoms. At finish — Wind S.E., force 3; weather and sea as before; tide, 4½ hours ebb; barometer, 29·42; transparency, 2 fathoms.
	E. 37·2	39·9	41·0 12 fath.		Plaice, . .	1	13½	...	...	...	...		
					Cod, . .	2	27	1	26	1	25		
					,, . .	1	24	...	...	...	...		
					Whitings, . .	2	5	...	...	...	...		
Station I. 19th May 1893. 6.55 a.m. to 9.0 a.m.	S. 49·6	46·8	46·7 7 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, fr.; *Temora longicornis*, f.; *Anomalocera pattersoni*, f.; Medusidæ, fr. young Decapod Crustacea, f.; young fish, r.; fish ova, f.	Grey skates, .	1	16	1	14	...	...	*Buccinum undatum*, r. (and spawn); *Eupagurus bernhardus*, r.; *Echinus esculentus*,	At beginning—Wind, calm; weather, fog; sea, easterly swell; tide, 2½ hours ebb; barometer, 29·55; transparency, 3 fathoms.
					Plaice, . .	12	14–15	19	11–12	11	10		
					Common dabs, .	4	9	8	7	7	6		
					Long rough dabs,	2	11	6	10	5	8		
					,, ,, .	3	7	...	...	...	...		
					Haddocks, . .	3	11	49	6–7	..	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—III. Montrose—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.				No.	Inches	No.	Inches	No.	Inches		
	Dry Bulb.	Surface.	Bottom.										
Station I. 19th May 1893. 6.55 a.m. to 9.0 a.m. —*continued.*	N. 56·8	46·0	46·0 16½ fath.	Bottom Tow-net. — Cumacea, f.; Amphipods, fr.; Copepoda (*Calanus, Pseudocalanus, Temora, Alteutha*), c.; Medusidæ, fr.; young Crustacea (Decapoda and Cirripedia), fr.; young fish, f.; fish ova, f.	Cod, . . .	1	41	2	16	1	8	*Alcyonium*, sp.; Zoophytes, f.; a quantity of mud.	At finish — Wind as before; weather, hazy; sea as before; tide, 4½ hours ebb; barometer, 29·55; transparency, 4¼ fathoms.
					Whitings, . .	2	10	3	8	...	...		
					Gurnards, . .	12	13–15	32	9–10½	187	7–8		
					,, . .	24	5–6	...	...	...	...		
					Anglers, . .	1	19	1	16	...	...		
Station II. 19th May 1893. 4.25 a.m. to 5.50 a.m.	W. 46·9	45·9	46·0	Surface Tow-net.—Boreophausidæ, r.; *Parathemisto*, sp. r.; *Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, r.; *Temora longicornis*, f.; *Acartia longiremis*, fr.; *Centropages*, sp. fr.; Medusidæ, fr.; young *Balani*, f.; young fish, f.; fish ova, f. Bottom Tow-net.—Boreophausidæ, f.; *Mysis*, sp. f.; Cumacea, fr.; Amphipoda (*Bathyporeia* and others), f.; Copepoda (*Calanus, Temora, Acartia, Centropages*), fr.; *Sagitta*, sp. fr.; *Appendicularia*, sp. f.; young Crustacea, f.; young Annelida, f.; young fish, f.; fish ova, f.	Thornback ray, .	1	18	...	...	...	...	*Eledon cirrhosa* (young), r.; *Eupagurus bernhardus*, r.; Zoophytes, f.	At beginning — Wind N.E., force 1; weather, hazy; sea, easterly swell; tide, high water; barometer, 29·54; transparency, 1½ fathoms. At finish—Wind, light airs; weather and sea as before; tide, 1½ hours ebb; barometer, 29·54; transparency, 3 fathoms.
					Plaice, . .	1	18	1	15	10	13		
					,, . .	5	10	...	...	...	...		
					Lemon sole, .	1	6	...	...	...	...		
					Common dabs, .	1	11	13	9	6	7		
					,, ,, .	9	5–6	...	...	...	...		
					Long rough dabs,	1	12	1	11	2	8		
					Haddocks, . .	5	11	2	10	6	8		
					,, . .	68	67	...	...	...	...		
					Whitings, . .	1	9	1	7	...	...		
					Gurnards, . .	59	10–11½	305	8–9	108	6–7		
					Anglers, . .	1	13	1	8	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—IV. Aberdeen.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 11th Feb. 1893. 8.40 a.m. to 10.45 a.m.	S. 40·8	40·6	41·0 10 fath.	Surface Tow-net. — *Calanus finmarchicus*, r.; *Sagitta*, sp. f.; Ctenophora, f.	Starry ray,	1	12	...	...	...	...	*Asterias rubens*, f.; *Alcyonium*, sp. r.; Zoophytes and weed, f.	At beginning—Wind N.W., force 4; weather, dull; sea, north-easterly swell; tide, high water; barometer, 29·05; transparency, 4 fathoms.
					Plaice,	1	7	4	16	8	14		
					,,	7	11-12	...	...	...	...		
					Lemon sole,	1	12	...	...	...	...		
	N. 39·0	40·6	41·0 15 fath.	Bottom Tow-net. — *Calanus finmarchicus*, r.; *Caligus*, sp. r.; *Sagitta*, sp. fr.; Ctenophora, f.	Common dabs,	1	12	1	8	2	7		At finish — Wind N.E., force 6; weather, dull, with showers; sea, rough; tide, 2 hours ebb; barometer, 29·12; transparency, 4 fathoms.
					,,	1	5	...	...	...	...		
					,,	1	9	2	7	...	...		
					Long rough dabs,	3	6½	...	...	...	...		
					Haddocks,	1	10	1	4½	...	...		
					Whitings,	1	6	...	...	...	...		
					Gurnard,								
Station II. 11th Feb. 1893. 11.20 a.m. to 12.30 p.m.	W. 39·0	40·8	41·3 9 fath.	Surface Tow-ne — Euphausidæ, r.; *Hyperia*, sp. r.; *Calanus finmarchicus*, r.; *Sagitta*, sp.fr.; Ctenophora, r.	Plaice,	2	16	2	15	4	13-14	*Buccinum undatum*, two specimens; *Asterias rubens*, fr.; *Alcyonium*, sp. f.; Zoophytes and weed, f.	At beginning—Wind N.E., force 6; weather, dull, with rain; sea, rough; tide, 2¾ hours ebb; barometer, 29·13; transparency, 4 fathoms.
					,,	4	10-12	...	...	..	...		
	E. 39·0	40·6	41·0 21½ fath.	Bottom Tow-net. — Euphausidæ, r.; *Parathemisto*, sp. r.; *Calanus finmarchicus*, r.; *Caligus*, sp. f.; *Sagitta*, sp. fr.; Ctenophora, r.	Common dabs,	1	9	1	6	...	...		At finish — Wind as before; weather, cloudy; sea, rough; tide, 4 hours ebb; barometer, 29·21; transparency, 4½ fathoms.
					Long rough dabs,	1	8	1	7	1	6		
					Haddocks,	12	6-6½	...	...	...	...		
Station III. 10th Feb. 1893. 11.5 p.m. to 2.40 p.m.	E. 43·0	40·4	41·0 16½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. f.	Starry rays,	1	13	1	12	1	9	*Portunus holsatus*, r.; *Asterias rubens*, f.; *Alcyonium*, sp. r.; a small quantity of	At beginning—Wind N.W., force 8; weather, dull, showery; sea, rough; tide, 5¾ hours ebb; barometer, 29·01; transparency, 3 fathoms.
					Plaice,	1		5	14	4	12-13		
					,,	3	10-11	...	...	...	...		
	W. 43·0	40·6	41·0 8 fath.	Bottom Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Caligus*,	Common dab,	1	10	...	...	...	...		
					Haddocks,	2	6½	2	5½	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—IV. Aberdeen—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
Station III. 10th Feb. 1893. 1.15 p.m. to 2.40 p.m. —*continued.*				sp. r.; *Sagitta*, sp. f.; Ctenophora, fr.								Zoophytes and weed.	At finish — Wind N.W., force 10; weather cloudy; sea, rough; tide, ¾ hour flood; barometer, 29·09; transparency, 2¾ fathoms.
Station IV. 10th Feb. 1893. 11.25 a.m. to 12.55 p.m.	N.E. 45·5 S.W. 43·0	40·4 40·2	41·0 13 fath. 41·0 11¼ fath.	Surface Tow-net. — *Sagitta*, sp. f.; Ctenophora, f. Bottom Tow-net. — *Mysis spiritus*, f.; *Sagitta*, sp. fr.; *Gammarus*, sp. r.	Starry rays, . Plaice, . . ,, . .	1 11 1 10 1 8 1 17 6 16 7 14–15 5 11						*Eupagurus bernhardus*, r.; *Asterias*, sp. fr.; *Amphidotus cordatus*, f.; a small quantity of Zoophytes and weed.	At beginning—Wind N.W., force 5; weather, cloudy; sea, moderate; tide, 4 hours ebb; barometer, 28·96; transparency, 3½ fathoms. At finish — Wind N.W., force 6; weather, dull, showery; sea, choppy; tide, 5¼ hours ebb; barometer, 29·00; transparency, 3 fathoms.
Station V. 10th Feb. 1893. 9.10 a.m. to 11.0 a.m.	N.E. 38·5 S.W. 46·0	40·4 40·2	40·8 10 fath. 41·0 10½ fath.	Surface Tow-net. — Euphausidæ, r.; *Parathemisto*, r.; *Sagitta*, sp. f.; Ctenophora, f. Bottom Tow-net. —Euphausidæ, f.; *Mysis spiritus*, c.; *Bathyporeia*, sp. fr.; *Gammarus*, sp. f.; *Calanus finmarchicus*, f.; *Sagitta*, sp. ab.; young Aurelia, r.; young pipefish, r.	Grey skates, . ,, . . Starry rays, . Plaice, . . ,, . . Long rough dabs, Haddocks, . . Cod, . . . ,, . . .	1 14 1 13 1 10 2 7 ... ... 4 12 1 11 ... ... 1 23 12 15–17 6 13 14 6 9–10 ... ... 1 6 ... ... 3 19 3 18 2 13 1 33 1 31 3 26½ 5 23						*Asterias*, sp. r.; *Actinia*, sp. r.; *Alcyonium*, sp. r.; a small quantity of Zoophytes and weed.	At beginning—Wind N.W., force 4; weather, slight haze; sea, slight; tide, 1¾ hours ebb; barometer, 28·86; transparency, 3 fathoms. At finish—Wind N.W., force 5;

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—IV. Aberdeen—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 10th Feb. 1893. 9.10 a.m. to 11.0 a.m. —*continued.*					Whiting, . .	1	6	...	...	...	...		weather, cloudy; sea, slight; tide, 3½ hours ebb; barometer, 28·95; transparency, 2¾ fathoms.
					Herrings, . .	4	3	...	...	...	...		
Station VI. 9th Feb. 1893. 9.50 a.m. to 11.20 a.m.	N. 40·5	40·6	41·0 12 fath.	Surface Tow-net.—Euphausidæ, f.; *Sagitta*, sp. ab.	Grey skates, .	2	12	...	...	...	...	*Asterias rubens*, f.; *Alcyonium*, sp. f.; a small quantity of weed and Zoophytes, among which were numerous Amphipods, chiefly *Gammarus*.	At beginning—Wind S., force 5; weather, dull; sea, south-westerly swell; tide, 2½ hours ebb; barometer, 29·40; transparency, 4 fathoms. At finish — Wind S.W., force 5; weather, hazy; sea, choppy; tide, 5 hours ebb; barometer, 29·35; transparency, 2½ fathoms.
	S. 42·0	40·4	40·8 13½ fath.	Bottom Tow-net.—*Mysis spiritus*, ab.; *Parathemisto*, sp. r.; *Calanus finmarchicus*, f.; young *Gammarus*, sp. fr.	Starry rays, .	2	11	...	...	...	...		
					Plaice, . .	2	17–18	2	15–16	1	14		
					,, . .	2	12	...	...	...	...		
					Haddocks, . .	3	17	1	16	2	14		
					,, . .	2	12	...	...	...	...		
					Cod, . .	1	31	2	26	...	...		
					Whiting, . .	1	6	...	...	...	...		
Station VII. 9th Feb. 1893. 11·55 a.m. to 1·45 p.m.	S. 41·5	40·8	41·1 22 fath.	Surface Tow-net.—Euphausidæ, f.; *Sagitta*, sp. ab.; young *Gammarus*, sp. f.	Plaice, . .	2	15	2	13	1	12	*Portunus holsatus*, r.; *Asterias rubens*, f.; *Alcyonium*, sp.; *Alcyonidium*, sp. f.; Zoophytes and weed, a quantity, among which Amphipods (*Gammarus*, sp. chiefly), were plentiful.	At beginning—Wind S.W., force 5; weather, hazy; sea, choppy; tide, 5½ hours ebb; barometer, 29·31; transparency, 5½ fathoms. At finish — Wind S.W., force 6; weather as before; sea, rough; tide, 1½ hours flood; barometer, 29·22; transparency, 4 fathoms.
	W. 42·0	40·8	41·1 22 fath.	Bottom Tow-net.—*Crangon allmanni*, r.; *Mysis spiritus*, v. ab.; young *Gammarus*, sp. c.; young sand eels, f.	,, . .	1	8½	...	...	...	...		
					Haddock, . .	1	6	...	...	...	...		
					Cod, . .	1	32	1	28	2	22½		
					,, . .	1	8½	...	...	...	...		
					Whiting, . .	1	10	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—IV. Aberdeen—*continued.*

Station, Date, and Time Trawl down.	Temperature.			Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish.						Invertebrate Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
	Air.	Water.											
	Dry Bulb.	Surface.	Bottom.			No.	Inches	No.	Inches	No.	Inches		
Station I. 16th May 1893. 9.15 a.m. 11.15 p.m.	S. 48·0	47·2	47·3 8½ fath.	Surface Tow-net.—*Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Anomalocera pattersoni*, c.; young Decapods, ab.; post-larval fish, f.	Grey skate,	1	13	...	...	...	...	*Portunus holsatus*, r.; *Eupagurus bernhardus*, f.; *Asterias rubens*, f.; *Alcyonium*, sp. f.	At beginning—Wind S.S.W., force 2; sea, slight; tide, 2¼ hours flood; barometer, 29·92; transparency, 3¼ fathoms. At finish — Wind S.S.E., force 3; weather, slight haze; sea, slight; tide, 4¼ hours flood; barometer, 29·90; transparency, 3¼ fathoms.
					Starry ray,	1	7½	...	...	...	...		
					Plaice,	11	14½	1	17	28	11–13		
					,,	7	9	...	...	...	...		
	N. 50·0	47·0	46·2 18 fath.	Bottom Tow-net.—*Pseudocuma*, sp. r.; *Caprella*, sp. r.; *Calanus finmarchicus*, fr.; *Temora longicornis*, fr.; *Caligus*, sp. r.; *Podon*, sp. f.; young Decapoda, and *Balani*, fr.; young starfish, f.; young Annelids, fr.; *Sagitta*, sp. f.; small Medusidæ, f.	Lemon soles,	1	13	3	11	3	9		
					Common dabs,	1	11	7	9½	11	6½		
					,,	21	5	...	...	...	...		
					Long rough dabs,	2	12	3	10	8	8		
					Haddocks,	23	5½–7	...	...	...	...		
					Gurnards,	22	10–11	101	8–9	73	5½–7		
Station II. 16th May 1893. 11.45 a.m. to 1.5 p.m.	W. 50·9	47·0	46·8 9 fath.	Surface Tow-net.—Boreophausidæ, r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Anomalocera pattersoni*, f.; young Decapod Custacea, c.; young fish, fr.; fish ova, f.	Plaice,	8	15	25	12–13	6	10	*Asterias*, sp. f.; Zoophytes, f.; very little besides fish in the net.	At beginning—Wind S.S.E., force 3; weather, slight haze; sea, slight; tide, 4¼ hours flood; barometer, 29·89; transparency, 2½ fathoms. At finish—Wind, weather and sea as before; tide, high water; barometer, 29·88; transparency, 4½ fathoms.
					,,	3	9	...	...	...	...		
					Lemon soles,	2	11	1	7	...	...		
					Common dabs,	4	10	14	7–8	24	6		
					,,	7	5	...	...	...	...		
					Flounder,	1	10	...	...	...	...		
	E. 48·9	47·3	45·4 22 fath.	Bottom Tow-net.—Amphipods (var. sp.), fr.; *Caprella*, sp. f.; *Calanus finmarchicus*, f.; *Temora longicornis*, fr.; young Decapoda, fr.; young Annelids, fr.; young starfish, f.; *Sagitta*, sp. fr.; *Tomopteris*, sp. r.	Long rough dabs,	7	11	5	7	...	...		
					Haddocks,	1	16	12	12–13	90	5½–7		
					Cod,	1	17	...	...	...	...		
					Whitings,	6	11	2	9½	1	7		
					,,	2	5	...	...	...	...		
					Gurnards,	2	14	43	10	63	8		
					,,	40	6	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—IV. Aberdeen—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station III. 16th May 1893. 1.40 p.m. to 3.15 p.m.	E. 48·9	46·0	46·1 20 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, fr.; *Temora longicornis*, fr.; *Centropages*, sp. f.; *Podon*, sp. f.; *Appendicularia*, sp. f.; young fish, f.; fish ova, f.	Starry ray,	1	9	...	...	...	...	*Asterias rubens*, fr.; very little in the net except fish.	At beginning.—Wind S.S.E., force 3; weather, overcast; sea, moderate; tide, ½ hour ebb; barometer, 29·86; transparency, 3 fathoms. At finish—Wind E. by S., force 3; weather and sea as before; tide 1¾ hours ebb; barometer, 29·85; transparency, 1¾ fathoms.
					Plaice,	2	16–18	18	13–15	12	12		
					,,	19	9–10½	...	...	...	...		
					Common dabs,	10	9	23	7	20	5–6		
					Long rough dabs,	4	11	8	9	3	7		
					Haddocks,	4	13	6	11	3	9		
	W. 48·9	47·0	47·0 10 fath.	Bottom Tow-net.—Boreophausidæ, f.; *Mysis*, sp. f.; *Pseudocuma cercaria*, c.; *Calanus finmarchicus*, f.; *Temora longicornis*, fr. *Sagitta*, sp. f.; young Decapod Crustacea, fr.; young Annelids, f.; young starfish, fr.	,,	66	5½–7½	...	...	...	...		
					Whitings,	5	11	10	9	1	7		
					Gurnards,	2	14	14	10–11	81	8–9		
					,,	47	6–7	...	...	...	...		
Station IV. 17th May 1893. 10.50 a.m. to 12.10 p.m.	N.E 42·9	47·0	46·1 15 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, f.; *Idotea marina*, r.; young Decapod Crustacea, f.; fish ova, f.	Plaice,	1	17	4	15	10	12	*Asterias rubens*, f.; very little in net except fish.	At beginning—Wind S.E., force 2; weather, overcast; sea, south-easterly swell; tide, 2¾ hours flood; barometer, 29·72; transparency, 3 fathoms. At finish — Wind, weather and sea as before; tide, 4 hours flood; barometer, 29·71; transparency, 3½ fathoms.
					,,	6	8½	...	...	...	...		
					Lemon sole,	1	9	...	...	...	...		
					Common dabs,	3	9	1	7½	6	5–6		
					Long rough dabs,	1	12	9	9	1	7		
					Haddocks,	1	21	6	16	11	14		
	S.W. 49·2	47·3	46·3 13 fath.	Bottom Tow-net damaged.	,,	51	9½–12	152	5½–8	...	...		
					Cod,	1	44	1	7	...	...		
					Whitings,	8	14	32	9½	3	7½		
					Gurnards,	32	10	92	8½	16	7		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—IV. Aberdeen—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 17th May 1893. 8.25 a.m. to 10.20 a.m.	N.E. 48·2	47·3	47·1 8 fath.	Surface Tow-net —*Calanus finmarchicus*, fr.; *Centropages*, sp. f.; *Podon*, sp. f.; young Decapod Crustacea, fr.; young Annelids, f.; fish ova, f.	Grey skates,	1	18	1	15	...	...	*Cancer pagurus*, r.; *Portunus*, sp. f.; *Asterias rubens*, f.; Zoophytes, f.	At beginning — Wind S.S.E., force 1; weather, overcast; sea, south-easterly swell; tide, ¼ hour flood; barometer, 29·76; transparency, 1½ fathoms.
					Plaice,	1	16	1	14	4	12		
					,,	1	10	...	...	...	...		
					Lemon soles,	1	6	...	...	...	...		
					Common dabs,	2	19	...	6	...	...		
	S.W. 48·2	47·7	46·7 10 fath.	Bottom Tow-net. — *Mysis spiritus*, f.; Cumacea, c.; Amphipods (var. sp.), fr.; *Calanus finmarchicus*, fr.; *Temora longicornis*, fr.; *Centropages*, sp. fr.; *Anomalocera patersoni*, r.; *Alteutha*, sp. f.; *Sagitta*, sp. fr.; *Tomopteris*, sp. fr.; *Pleurobrachia*, sp. f.; young Decapods, fr.; young starfish, fr.; *Appendicularia*, sp. f.	Long rough dab,	1	12	...	...	...	...		At finish—Wind S.E., force 2; weather and sea as before; tide, 2¼ hours flood; barometer, 29·75; transparency, 2 fathoms.
					Haddocks,	2	19	4	12	3	10		
					,,	182	7½–6	...	...	...	...		
					Whitings,	2	12–13	9	10–11	6	8		
					Gurnards,	2	11	8	8½	...	...		
Station VI. 17th May 1893. 4.30 p.m. to 6.0 p.m.	N. 48·9	46·3	46·2 14 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, f.; *Acartia longiremis*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.	Grey skates,	1	16	1	11	...	...	*Asterias*, sp. f.; *Alcyonium*, sp. f.; *Alcyonidium*, sp.; Zoophytes and weed, f.	At beginning—Wind S.E., force 2; weather, overcast; sea, south-easterly swell; tide, 2½ hours ebb; barometer, 29·67; transparency, 3½ fathoms.
					Plaice,	1	22	3	14-15	1	9		
					Lemon sole,	1	13	...	...	...	...		
					Common dabs,	3	8	...	...	...	...		
					Haddocks,	2	11	46	6–7½	...	...		
					Whitings,	4	8	1	7	...	...		
	S. 47·6	46·2	46·1 15¼ fath.	Bottom Tow-net.—Copepoda (*Calanus*, *Temora*, *Centropages*, &c.), ab.; Amphipods (var. sp.), ab.; young Crustacea (Decapoda, Schizopoda, Cirripedia), ab.	Gurnards,	6	9	...	...	...	...		At finish — Wind S.E., force; weather, hazy; sea as before; tide, 4 hours ebb; barometer, 29·69; transparency, 3½ fathoms.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—IV. Aberdeen—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VII. 17th May 1893. 2.15 p.m. to 4.15 p.m.	N. 50·0	46·0	45·9 30 fath.	Surface Tow-net. — *Calanus finmarchicus*, f.; *Acartia longiremis*, f.; *Temora longicornis*, f.; *Parathemisto*, sp. f.; *Sagitta*, sp. f.; small Medusidæ, f.	Plaice, . .	6	21	11	16	18	12–14	*Portunus holsatus*, f.; *Asterias rubens*, f.; Zoophytes and weed, small quantity.	At beginning—Wind S., force 2; weather, cloudy; sea, south-easterly swell; tide, ½ hour ebb; barometer, 29·72; transparency, 5 fathoms.
					„ . .	2	10	...	...	...	...		
					Lemon sole, .	1	10	...	...	...	...		
					Common dabs, .	1	9	17	7	2	4½		
					Haddocks, . .	2	12	1	10	14	6–7		
	S. 48·9	46·0	45·9 17 fath.	Bottom Tow-net. — Copepoda (*Calanus*, *Temora*, *Centropages*, *Atteutha*, &c.), v. ab.; Amphipoda, ab.; *Sagitta*, sp., fr.; young Decapod Crustacea, fr.	Cod, . . .	1	33	2	19	3	16		At finish — Wind S.E., force 2; weather, overcast; sea as before; tide, 2¼ hours ebb; barometer, 29·67; transparency, 5 fathoms.
					Whiting, . .	1	6	...	...	...	...		
					Gurnards, . .	1	14	1	12	33	10		
					„ . .	15	8	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
Station I. 29th Apr. 1893. 11.15 a.m. to 1.10 p.m.	E. 48·9	47·3	45·8 8½ fath.	Surface Tow-net.—*Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Acartia longiremis*, f.; *Centropages*, sp. f.; *Evadne*, sp. f.; young Decapods, fr.; young *Balani*, f.; small Medusidæ, fr.; young fish, fr.; fish ova, c.	Plaice, . .	2	24½	3	21·23	4	16 18	*Asterias*, sp. fr.; *Hyas coarctatus*, r.; *Astropecten irregularis*, r.; *Amphidotus cordatus*, fr.; sponge (? *Hemiasdon*), f.; Zoophytes and weed, fr.	At beginning—Wind W. by N., force 2; weather, cloudy; sea, slight; tide, 5½ hours flood; barometer, 29·66; transparency, (disc seen on the bottom), 8½ fathoms. At finish — Wind W.N.W., force 4; weather, cloudy; sea, slight; tide, 1½ hours ebb; barometer, 29·64; transparency (disc seen on the bottom), 6½ fathoms.
					,, . .	10	11 15	...	...	...	...		
					Common dabs, .	1	9	7	7 8	6	4 6		
					Gurnards, . .	2	5½	...	...	...	...		
	W. 50·0	47·0	46·0 6⅜ fath.	Bottom Tow-net. *Pseudocuma cercaria*, r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Acartia longiremis*, f.; *Sagitta*, sp. f.; *Appendicularia*, sp. f.; young *Balani*, f.; young Decapods, fr.										
Station II. 3rd May 1893. 10.5 a.m. to 11.50 a.m.	E. 47·8	46·8	43·3 18½ fath.	Surface Tow-net.—Very little of anything.	Plaice, . .	1	11	2	9	1	7	*Asterias*, sp. f.; *Solaster papposa*, f.; *Ophiothrix rosula*, f.; *Echinus esculentus*, f.; *Alcyonium*, fr.	At beginning—Wind E., force 1; weather, slight haze; sea, slight; tide, 2½ hours flood; barometer, 30·04; transparency, 6¼ fathoms. At finish — Wind E., force 1; weather, hazy, with rain; sea, smooth; tide, 4 hours flood; barometer, 30·08; transparency, 5½ fathoms.
					Common dabs, .	1	9	6	8	11	7		
					,, ,, .	8	4 5	...	...	...	...		
	W. 47·8	46·5	43·5 14¼ fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Evadne nordmanni*, f.; a Cumacean sp. ?; young Decapods and *Balani*, f.; small Medusidæ, f.; young Anemones (? *Peachia*), fr.; young fishes (post-larval), f.	Witch soles, .	5	17	3	15	...	...		
					Long rough dabs,	1	11	2	9	5	8		
					,, ,,	9	5 6	...	...	...	...		
					Gurnards, . .	2	12 14	4	9	5	8		
					,, . .	8	5 6	...	...	...	...		
					Angler, . .	1	20	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c. brought up in Trawl Net.	Wind, Weather, and other Observations.
Station III. 3rd May 1893. 12.50 p.m. to 2.5 p.m.	E. 48·9	44·9	45·0 9 fath.	Surface Tow-net.—*Rissoa*, sp. r.; *Idotea marina*, f.; Boreophausidæ, r.; *Calanus finmarchicus*, f.; *Temora longicornis*, fr.; *Acartia longiremis*, f.; small Medusidæ, fr.; young Decapods, f.; young fish, f.; fish ova, r.	Thornback rays,	3	20	...	...	...	...	*Pecten opercularis*, *Pecten pusio*, r.; *Mytilus modiolus*, fr.; *Fusus antiquus*, r.; *Buccinum undatum*, r.; *Hyas araneus*, f.; *Hyas coarctatus*, f.; *Asterias*, sp. f.; *Solaster papposa*, f.; *Ophiothrix rosula*, fr.; *Echinus miliaris*, r.; *Echinus esculentus*, fr.; *Strongylocentrotus drobachiensis*, f.; *Cucumaria*, sp. f.; Zoophytes and weed, fr.	At beginning — Wind E.S.E., force 2; weather, hazy; sea, smooth; tide, 5¼ hours flood; barometer, 30·08 transparency, 5½ fathoms. At finish—Wind and weather as before; sea, smooth; tide, ¼ hour ebb; barometer, 30·11; transparency, 3½ fathoms.
					Plaice, . .	3	15	14	13	4	11		
					Lemon soles, .	1	13	1	10	...	...		
					Common dabs, .	3	8	2	6	3	5		
					Cod, . . .	*1	36	1	25	1	10		
					,, . . .	1	7	...	...	...	...		
					Angler, . .	1	21	...	...	...	...		
	W. 51·8	47·0	45·2 9 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, fr.; *Acartia longiremis*, f.; *Centropages*, sp. f.; *Parapontella brevicornis*, f.; *Podon*, sp. fr.; *Evadne*, sp. f.; larval Annelids, f.; young fish, fr.	Gurnard, . .	1	10	...	...	...	...		
Station IV. 2nd May 1893. 11.35 a.m. to 1.25 p.m.	E. 48·2	46·0	44·9 13 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Acartia longiremis*, fr.; small Medusidæ, f.; young *Balani*, fr.; fish ova, f.	Plaice, . .	4	16½	2	14	1	11	*Asterias*, sp. c.; *Astropecten irregularis*, r.; *Amphidotus cordatus*.	At beginning — Wind E. by N., force 2; weather, cloudy; sea, slight; tide, 5¼ hours flood; barometer, 29·89; transparency, 8½ fathoms. At finish—Wind E., force 3; weather, overcast; sea, slight; tide, 1 hour ebb; barometer, 29·87; transparency, 8½ fathoms.
					,, . .	10	6–9	...	...	...	...		
					Lemon sole, .	1	16	...	...	...	...		
					Common dabs, .	2	11–12	8	9–10	7	7–8		
					,, ,, .	7	4½–6	...	...	...	...		
	W. 47·1	47·5	44·1 9¾ fath.	Bottom Tow-net.—*Calanus finmarchicus*, c.; *Temora longicornis*, fr.; *Sagitta*, sp. f.; *Tomopteris*, sp. r.; young Decapods, ab.; young fish, fr.	Angler, . .	1	24	...	...	...	...		

• The stomach of this cod contained 103 sand eels besides other fish remains.

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 2nd May 1893. 9.30 a.m. to 11.0 a.m.	N.E. 8·7	45·8	43·7 17½ fath.	Surface Tow-net.—*Calanus finmarchicus*, fr.; *Acartia longiremis*, f.; small Medusidæ, r.; young *Balani*, f.; fish ova, fr.	Plaice,	1	24	2	22	4	15–16	*Ascidia*, sp. c.; *Asterias*, c.; *Solaster endeca*, fr.; *Amphidotus cordatus*, f.; Spongidæ and *Alcyonium*, sp. f.	At beginning — Wind S.S.E., force 1; weather, clear; sea, smooth; tide, 3½ hours flood; barometer, 29·89; transparency, 8½ fathoms.
					,,	8	6–11	...	...	...	...		
					Common dabs,	5	8–9	38	7	23	6		
					,, ,,	21	5	...	...	...	...		
	S.W. 9·0	45·1	43·9 14 fath.	Bottom Tow-net. — *Calanus finmarchicus*, c.; *Temora longicornis*, fr.; small Medusidæ, fr.; young Decapods, ab.; *Sagitta*, sp. f.; young *Balani*, sp. f.; young fish, fr.	Cod,	1		...	...	...	...		At finish—Wind E. by N., force 1; weather, cloudy; sea, smooth; tide, 4¾ hours flood; barometer, 29·89; transparency, 9 fathoms.
					Gurnards,	1	11	18	10	16	8		
					,,	50	4–6	...	...	...	...		
Station VI. 2nd May 1893. 1.40 p.m. to 3.30 p.m.	W. 6·7	46·5	44·1 12½ fath.	Surface Tow-net. — *Calanus finmarchicus*, fr.; *Acartia longiremis*, f.; small Medusidæ, f.; young *Balani*, f.; fish ova, f.	Thornback ray,	1	11	...	...	...	...	*Fusus antiquus*, f.; *Fusus gracilis*, r.; *Asterias*, sp. fr.; *Solaster endeca*, f.; *Echinus esculentus*, f.; *Alcyonium*, sp. f.	At beginning—Wind E., force 4; weather, overcast; sea, choppy; tide, 1¼ hours ebb; barometer, 29·85; transparency, 9 fathoms.
					Plaice,	2	19	1	13	5	9		
					Lemon sole,	1	15	...	...	...	...		
					Common dabs,	1	10	2	9	18	8		
					,, ,,	24	6	...	...	...	...		
	E. 8·0	45·9	43·6 18¼ fath.	Bottom Tow-net.—*Calanus finmarchicus*, c.; *Temora longicornis*, fr.; *Sagitta*, sp. f.; young Decapods, ab.; young fish, fr.	Haddocks,	1	13	2	10	1	7		At finish — Wind E., force 5; weather, overcast; sea, choppy; tide, 3 hours ebb; barometer, 29·85; transparency, 6 fathoms.
					Cod,	1	24	2	21	3	17		
					,,	2	10–13	...	...	...	...		
					Gurnards,	2	11	2	9	2	7		
					,,	9	6	...	...	...	...		
					Cat fish,	1	33	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VII. 8th May 1893. 8.40 a.m. to 10.20 a.m.	W. 8·3	46·9	44·3 22½ fath.	Surface Tow-net. — *Parathemisto*, sp. r.; *Calanus finmarchicus*, f.; *Anomalocera pattersoni*, r.; young Decapods, ab.; fish ova, fr.	Lemon soles,	1	16	1	15	1	9	*Asterias*, sp. f.; *Echinus esculentus*, r.; *Alcyonium*, sp. f.; a small quantity of Zoophytes and weed.	At beginning — Wind E.S.E., force 5; weather, clear; sea, choppy; tide, 5 hours ebb; barometer, 30·57; transparency, 7 fathoms.
					,, ,,	2	6	...	...	...	...		
					Common dabs,	3	8–9	18	7	6	6		
					,, ,,	5	5	...	...	...	...		
	E. 9·0	46·1	44·6 30 fath.	Bottom Tow-net. — *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Centropages*, sp. f.; *Anomalocera pattersoni*, r.; young Decapods, f.; young *Balani*, f.; young Ophiuridæ, fr.	Long rough dabs,	2	9	2	7	3	6		At finish — Wind E.S.E., force 4; weather as before; sea, moderate; tide, ¼ hour flood; barometer, 30·50; transparency, 8½ fathoms.
					,, ,,	1	5	...	...	...	...		
					Haddocks,	1	20	1	15	1	11		
					,,	52	5½–7½	...	...	...	...		
					Whitings,	1	13	1	6	...	...		
					Gurnards,	1	13	1	10	3	7–8		
					,,	8	4½–5½	...	...	...	...		
					Brassie,	1	8	1	7	2	6		
Station VIII. 8th May 1893. 1.5 p.m. to 2.55 p.m.	S. 10·5	47·8	44·2 33 fath.	Surface Tow-net.— *Calanus finmarchicus*, f.; *Acartia longiremis*, f.; *Centropages*, sp. f.; young Decapods and *Balani*, f.; fish ova, fr.	Thornback rays,	1	20	1	14	...	...	Ascidians, f.; *Asterias*, sp. fr.; *Amphidotus flavescens*, f.; *Cucumaria*, sp. (large, dark coloured), fr.; *Actinoloba dianthus*, f.; *Alcyonium*, f.; Zoophytes and weed, a small quantity.	At beginning — Wind E.S.E., force 4; weather, moderately clear; sea, moderate; tide, 3 hours flood; barometer, 30·49; transparency, 9½ fathoms.
					Starry ray,	1	12	...	...	...	...		
					Plaice,	1	16	1	15	1	14		
					Lemon soles,	1	15	2	6½	...	...		
					Common dabs,	2	11–12	1	9	4	8		
					,, ,,	140	5–7	...	...	...	...		
	N. 11·5	46·5	43·8 33 fath.	Bottom Tow-net. — *Calanus finmarchicus*, fr.; *Acartia longiremis*, f.; *Temora longicornis*, r.; *Alteutha*, sp. r.; young Decapods and *Balani*, f.; young Ophiuridæ, fr.	Witch sole,	1	16	...	...	...	...		At finish — Wind E.S.E., force 5; weather, cloudy; sea, choppy; tide, 4¾ hours flood; barometer, 30·49; transparency, 9 fathoms.
					Sail fluke,	1	15	...	...	...	...		
					Long rough dabs,	1	11	10	8	2	7		
					,, ,,	8	6	...	...	...	...		
					Haddocks,	1	15	3	12	9	10		
					,,	85	6–7½	...	...	...	...		
					Cod,	1	11	1	10	...	...		
					Whitings,	1	13	4	12	4	10		
					,,	1	7	...	...	...	...		
					Gurnards,	1	13	9	9–10	15	7–8		
					,,	8	5	...	...	...	...		
					Angler,	1	36	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station IX. 8th May 1893. 3.50 p.m. to 5.30 p.m.	N. 8·9	47·3	43·7 30½ fath.	Surface Tow-net.—*Calanus finmarchicus*, ab.; young Decapods, f.; fish ova, fr.	Thornback rays,	1	20	1	11	...	...	*Buccinum undatum*, f.; Ascidians, c.; *Asterias rubens*, f.; *Spatangus purpureus*, fr.; *Cucumaria* (large, dark coloured), f.; *Actinoloba dianthus*, f., a small quantity.	At beginning — Wind S.E., force 6; weather, cloudy; sea, rough; tide, 5¾ hours flood; barometer, 30·47; transparency, 9 fathoms.
					Starry ray,	1	5	...	...	...	...		
					Plaice,	2	24–25	1	19	3	16–17		
					,,	2	13	...	...	...	...		
	S. 8·9	47·5	43·4 30½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Centropages*, sp. f.; young Decapods, fr.; young *Balani*, f.; *Sagitta*, r.	Common dabs,	1	12	5	8	26	7		At finish — Wind S.E., force 6; weather, cloudy; sea, rough; tide, 1 hour ebb; barometer, 30·45; transparency, 8½ fathoms.
					,, ,,	43	4½–7	...	...	...	...		
					Long rough dabs,	2	8	8	7	5	6		
					Haddocks,	2	16–18	9	1–13	1	9		
					,,	15	6½–8	...	...	...	...		
					Whitings,	1	13	1	12	1	11		
					Gurnards,	1	15	1	12	3	10–11		
					,,	23	5½–8	...	...	...	...		
					Anglers,	2	31	1	21	...	...		
					Catfish,	1	39	...	...	...	...		
Station X. 9th May 1893. 2.5 p.m. to 3.45 p.m.	W. 11·5	48·0	43·5 16 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; young Decapods, f.; fish ova, f.	Plaice,	1	22	3	18	4	15–16	*Asterias rubens*, f.; *Solaster papposa*, f.; *Astropecten irregularis*, f.; *Echinus esculentus*, f.; *Alcyonium*, sp. c.	At beginning—Wind E., force 3; weather, moderately clear; sea, slight; tide, 2 hours flood; barometer, 30·39; transparency, 9 fathoms.
					,,	2	13–14	...	...	...	...		
					Lemon soles,	1	15	1	7	...	...		
					Common dabs,	3	9–10	18	7–8	21	4–6		
	E. 11·0	47·8	44·9 14½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, r.; *Temora longicornis*, r.; small Medusidæ, f.; young Gastropods, f.; young Decapods, f.; post-larval fish, f.	Brill,	1	16	...	...	...	...		At finish — Wind E., force 4; weather as before; sea, moderate; tide, 3¾ hours flood; barometer, 30·38; transparency, 9½ fathoms.
					Haddocks,	1	15	2	12	1	11		
					Haddocks,	3	7	...	...	...	...		
					Cod,	2	16	8	14	2	12		
					,,	1	8	...	...	...	...		
					Gurnard,	1	5	...	...	...	...		
					Anglers,	1	30	1	22	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station XI. 10th May 1893. 10.35 a.m. to 12.35 p.m.	W. 12·0	46·9	45·8 22 fath.	Surface Tow-net. — *Calanus finmarchicus*, fr.; young Decapods, f.; fish ova, fr.	Starry ray,	1	12	...	...	...	...	*Mytilus modiolus*, fr.; *Buccinum undatum*, fr.; *Fusus antiquus*, r.; *Asterias rubens*, c.; *Astropecten irregularis*, r.; *Spatangus purpureus*, fr.; *Cucumaria*, sp. (large, dark coloured), fr.; *Alcyonium*, sp. c.; stones, fr.	At beginning — Wind S.W., force 1; weather, hazy; sea, slight easterly swell; tide, 5 hours ebb; barometer; 30·33; transparency, 6½ fathoms. At finish—Wind, weather and sea as before; tide, 1 hour flood; barometer, 30·31; transparency, 7 fathoms.
	E. 11·1	47·0	46·0 23 fath.	Bottom Tow-net.—*Calanus finmarchicus*, fr.; *Temora*, sp. r.; *Centropages*, sp. r.; *Sagitta*, sp. r.; small Medusidæ, f.; young starfish and Annelids, f.	Plaice,	1	27½	3	30–24	6	15–17		
					,,	1	11	...	...	...	..		
					Lemon soles,	1	15	2	11–12	1	7		
					,, ,,	2	6	...	...	...	...		
					Common dabs,	1	9	3	7	8	6		
					,, ,,	8	5	...	...	...	...		
					Haddocks,	10	15–17½	9	11½–13	5	10		
					,,	21	6½–8	...	...	...	...		
					Cod,	9	14–16½	6	12–13	2	9		
					,,	7	7½	...	...	...	...		
					Whiting,	1	16	...	...	...	...		
					Gurnards,	9	11	9	9	9	8		
					,,	5	6	...	...	...	...		
					Anglers,	1	29	1	11	...	...		
Station XII. 10th May 1893. 1.20 p.m. to 3.25 p.m.	N. 11·8	46·9	45·7 24¾ fath.	Surface Tow-net. — *Calanus finmarchicus*, fr.; *Anomalocera pattersoni*, f.; young Decapods, fr.; fish ova, fr.	Plaice,	2	26–27½	3	22-24	3	17-19	*Pecten opercularis*, r.; *Mytilus modiolus*, fr.; *Fusus antiquus*, r.; *Asterias rubens*, f.; *Goniaster phrygianus*, f.; *Echinus esculentus*, c.; *Spatangus purpureus*, f.; *Cucumaria* sp. (large, dark coloured), c.; *Alcyonium*, sp. f.; Zoophytes, f.	At beginning — Wind S.W., force 1; weather, hazy; sea, slight easterly swell; tide, 1¾ hours flood; barometer, 30·30; transparency, 6½ fathoms. At finish—Wind S., force 1; weather and sea as before; tide, 3¾ hours flood; barometer, 30·27; transparency, 6 fathoms.
					,,	1	15	...	...	...	...		
	S. 11·5	47·4	45·9 22 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Centropages*, sp. f.; *Sagitta*, sp. f.; young Decapods, f.; post-larval fish, r.	Lemon soles,	2	16	8	14	7	8½		
					Common dabs,	1	15	1	8	19	6½		
					,, ,,	12	5	...	...	...	...		
					Haddocks,	6	19	27	16–18	21	14		
					,,	55	12	33	10	159	6½–8½		
					Cod,	1	33	2	20–24	8	14–16		
					,,	5	10–12½	5	9	2	6		
					Whitings,	1	15	4	13	1	11		
					,,	1	7	...	...	...	...		
					Gurnards,	4	14	37	9½–11	22	7½		
					,,	9	5	...	...	...	...		
					Catfish,	1	26	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—I. Moray Firth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station XIII. 10th May 1893. 4.30 p.m. to 6.35 p.m.	S. 10·7	47·3	45·8 29 fath.	Surface Tow-net.—*Calanus finmarchicus*, fr.; young Decapods, ab.; fish ova, f. Bottom Tow-net.—*Calanus finmarchicus*, f.; young *Balani*, f.	Grey skate,	1	32	...	...	...	...	*Buccinum undatum*, r.; *Fusus antiquus*, Ascidians, f.; *Hyas coarctatus*, f.; *Eupagurus prideauxi*, *Ophiothrix rosula*, f.; *Asterias*, sp. fr.; *Goniaster phrygianus*, f.; *Astropecten irregularis*, f.; *Echinus esculentus*, fr.; *Spatangus purpureus*, c.; *Alcyonium*, sp. ab.; Zoophytes, f.	At beginning — Wind S., force 1; weather, hazy; sea, slight easterly swell; tide, 4¾ hours flood; barometer, 30·27; transparency, 8¼ fathoms. At finish—Wind, calm; weather and sea as before; tide, ¾ hour ebb; barometer, 30·25; transparency, 8¼ fathoms.
	N. 10·8	47·3	45·6 29 th		Plaice,	2	22–24	2	19	1	18		
					,,	1	10	...	...	...	...		
					Lemon soles,	7	16	2	14	9	12–13		
					,, ,,	1	7½	...	...	...	...		
					Common dabs,	23	7½	17	5–6	...	...		
					Long rough dab	2	7	1	5	...	...		
					Haddocks,	2	19½	5	15½	18	11–13		
					,,	90	6½–10	...	...	...	...		
					Cod,	3	12–14	4	16–18½	2	7		
					Whitings,	3	12–13	1	10	1	8		
					,,	1	5	...	...	...	...		
					Gurnards,	10	10	19	8½	9	7½		
					,,	2	5	...	...	...	...		
					Brassie,	1	7½	...	...	...	...		
Station XIV. 11th May 1893. 4.50 a.m. to 6.50 a.m.	S. 9·3	46·5	45·0 37 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; young Decapods, fr.; fish ova, fr. Bottom Tow-net.—*Calanus finmarchicus*, ab.; *Pseudocalanus elongatus*, f.; *Anceus*, sp. r.; young *Balani*, ab.; young star-fish, f.; *Nerine*, sp. r.; post-larval fish, r.	Grey skate,	1	16	...	...	...	...	Ascidians, ab.; *Asterias*, sp. f.; *Spatangus purpureus*, ab.; *Cucumaria*, sp. (large, dark coloured), r.; *Alcyonium*, sp. r.	At beginning—Wind W.S.W., force 3; weather, overcast; sea, moderate; tide, 4¼ hours flood; barometer, 30·15; transparency, 8 fathoms. At finish — Wind, weather and sea as before; tide, high water; barometer, 30·15; transparency, 8 fathoms.
	N. 9·8	47·0	46·6 36½ fath.		Plaice,	1	18	...	...	...	...		
					Common dabs,	3	9	8	8	15	6		
					,, ,,	6	5	...	...	...	...		
					Long rough dabs,	6	6	...	...	...	...		
					Haddocks,	1	13	5	12	77	6–8		
					Whitings,	1	14	1	13	1	12		
					Gurnards,	4	13	7	9	1	7		
					,,	2	5½	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station XV. 10th May 1893. 7.15 a.m. to 9.15 a.m.	S. 13·0	46·3	44·6 27 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; small Medusidæ, f.; young Decapods, f.; fish ova, fr.	Starry ray,	1	11½	...	...	...	...	*Pecten opercularis*, r.; *Pusus antiquus*, r.; Ascidians, ab.; *Eupagurus prideauxi*, f.; *Asterias*, sp. c.; *Luidia ciliaris*, *Goniaster phrygianus*, fr.; *Echinus esculentus*, c.; *Spatangus purpureus*, fr.; *Amphidotus cordatus*, f.; *Cucumaria*, sp. (large, dark coloured), f.; *Alcyonium*, sp. fr.; Zoophytes, fr.	At beginning — Wind variable, light; weather, slight haze; sea, slight easterly swell; tide, 1¾ hours ebb; barometer, 30·37; transparency, 6½ fathoms. At finish—Wind W.S.W., force 1; weather and sea as before; tide, 3¾ hours ebb; barometer, 39·34; transparency, 7 fathoms.
	N. 10·9	46·9	45·0 30½ fath.	Bottom Tow-net.—*Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Sagitta*, sp. f.; young Decapods, c.; young *Balani*, f.	Plaice,	1	18	6	14–16	...	...		
					Lemon sole,	1	16	...	...	...	...		
					Common dabs,	1	8	4	6½	19	5½		
					Long rough dab,	1	7	...	...	...	...		
					Solenette,	1	3¼	...	...	...	...		
					Haddocks,	1	13	2	12	1	11		
					,,	4	6½–8	..	...	...	...		
					Cod,	1	15	...	...	...	...		
					Whiting,	1	15	...	...	...	...		
					Gurnards,	7	10–12½	9	8½	1	7		
					,,	11	5½	...	...	...	...		
					Dragonet,	1	7	...	...	...	...		
Station XVI. 11th May 1893. 9.45 a.m. to 11.50 a.m.	N. 10·8	47·3	43·9 35 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; young Decapods and *Balani*, fr.; fish ova, f.	Starry rays,	2	11	1	10	...	...	Ascidians, f.; *Eupagurus prideauxi*, f.; *Asterias rubens*, f.; *Luidia ciliaris*, r.; *Goniaster phrygianus*, r.; *Echinus esculentus*, fr.; *Brissopsis lyrifera*, r.; *Astropecten irregularis*, r.; *Filograna im-*	At beginning — Wind W., force 3; weather, overcast; sea, moderate; tide, 3 hours ebb; barometer, 30·15; transparency, 8 fathoms. At finish — Wind W., force 2; weather as before;
	S. 12·2	46·7	43·6 34 fath.	Bottom Tow-net.—Boreophausidæ, f.; *Calanus finmarchicus*, ab.; *Pseudocalanus elongatus*, f.; *Sagitta*, sp. f.; young Decapod Crustacea, v. ab.;	Common dabs,	1	7	3	6	...	...		
					Long rough dabs,	3	8	3	7	4	5		
					Haddocks,	2	15	1	13	3	10–11		
					,,	53	6–8	...	...	...	...		
					Cod,	1	14	1	12	1	11		
					Gurnard,	1	9	...	...	...	...		
					Angler,	1	24	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station XVI. 11th May 1893. 9.45 a.m. to 11.50 a.m. —*continued.*				young *Balani*, f.; young Gastropods, f.; post-larval fish, f.								*plexa*, fr.; *Actinoloba*, sp. and other Anemones, c.; *Hymeniacidon*, sp. r.	sea, slight; tide, 5 hours ebb; barometer, 30·14; transparency, 7 fathoms.
Smith Bank. 4th May 1893. Shrimp-net. 5.20 p.m. to 6.0 p.m.	E. 6.5	45·4	44·5 22 fath.	Surface Tow-net. – *Calanus finmarchicus*, ab.; young Decapods, fr.; young *Balani*, f.; fish ova, f.	Common dabs, .	2	5	...	...	...	...	*Mytilus modiolus*, f.; *Trochus sisyphinus*, fr.; *Asterias*, sp. f.; *Echinus esculentus*, r.; *Amphidotus flavescens*, r.; *Cucumaria* (large, dark coloured ? pentactes), fr.; *Alcyonium*, sp. fr., attached to stones.	At beginning—Wind S.E., force 5; weather, hazy; sea, rough; tide, 3¾ hours ebb; barometer, 30·23; transparency (sea too rough). At finish — Wind S.E., force 5; weather, hazy; sea, rough; tide, 4½ hours ebb; barometer, 30·23; transparency (sea too rough).
					Haddocks, .	1	8	1	7	1	6		
					Cod, . .	1	II	1	7	1	6		
					,, . .	4	4–5	...	...	...	...		
					Gadus minutus, .	1	4½	8	4	4	3½		
					Gurnard, . .	1	3	...	...	...	...		
Station VII. 8th May 1893. Shrimp-net. 10.30 a.m. to 11.5 a.m.	E. 9·0	46·1	44·6 30 fath.	Surface Tow-net.—*Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Acartia longiremis*, f.; *Centropages*, sp. f.; *Evadne*, sp. fr.; Small Medusidæ, f.; young Decapods, fr.; young *Balani*, f.; fish ova, fr.	Common dabs, .	2	9	17	7–8	10	5½	*Fusus gracilis*, r.; *Asterias*, sp. f.; *Solaster endeca*, r.; Ascidians, f.; *Amphidotus flavescens*, c.; *Alcyonium*, f.	At beginning — Wind E.S.E., force 4; weather, moderately clear; sea, moderate; tide, ½ hour flood; barometer, 30·50; transparency, 8½ fathoms.
					,, ,, .	19	3–4½	...	...	...	...		
					Long rough dabs,	13	6½	7	5½	13	3–4		
					Haddocks, . .	83	6-7	...	...	...	...		
					Cod, . . .	1	9	...	...	...	...		
					Whitings, . .	2	6½	1	5	...	...		
					Brassie, . .	1	7	3	5½	5	4		
					Gurnards, . .	2	4½	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station VIII. 8th May 1893. Shrimp-net. 12.20 p.m. to 12.55 p.m.	E. 10·5	47·8	44·2 33¾ fath.	Surface Tow-net.—*Calanus finmarchicus*, fr.; *Acartia longiremis*, f.; *Centropages*, sp. f.; young Decapods and *Balani*, f.; fish ova, fr.	Lemon soles,	1	15	1	6	...	...	Ascidians, f.; *Nephrops norvegicus*, r.; *Asterias*, sp. f.; *Luidii sarsii*, fragments; *Astropecten irregularis*, r.; *Amphidotus flavescens*, r.; *Actinoloba dianthus*, f.; *Alcyonium*, sp. r.	At finish—Wind E.S.E., force 4; weather, moderately clear; sea, moderate tide, 3½ hours flood; barometer, 30·49; transparency, 9½ fathoms.
					Common dabs,	9	8	6	6	2	7		
					,, ,,	32	3–5	...	...	...	...		
					Long rough dabs,	2	8	25	6	35	5		
					,, ,,	42	3½–4½	...	...	...	...		
					Haddocks,	3	11	19	6½–8	...	...		
					Cod,	1	11	1	5½	...	..		
					Whitings,	1	11	13	5½ 6½	...	...		
					Gadus minutus,	1	5½	...	...	...	...		
					Gurnards,	1	8	3	5	1	4		
					Labrus, sp. (juv.),	1	4	...	...	...	...		
					Pogge,	1	3	...	...	...	...		
					Dragonets,	5	5	4	4	1	3		
Station XIII. 10th May 1893. Shrimp-net. 6.52 p.m. to 7.30 p.m.	N. 10·8	47·3	45·6 29 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; young Decapod Crustacea, ab.; fish ova, very few.	Plaice,	1	14	...	...	...	...	*Pecten opercularis*, r.; *Hyas coarctatus*, f.; *Asterias rubens*, fr.; *Echinus esculentus*, r.; *Spatangus purpureus*, r.; *Alcyonium*, sp. f.	At beginning — Wind calm; weather, hazy, with rain; sea, slight easterly swell; tide, 1 hour ebb; barometer, 30·25; transparency, 8 fathoms.
					Lemon soles,	1	15	1	13	1	6½		
					Common dabs,	1	9	6	7	12	4½		
					Long rough dabs,	2	6	...	...	...	...		
					Haddocks,	7	12½	3	11	3	9		
					,,	157	5½–7½	...	...	...	...		
					Cod,	1	16	...	...	...	...		
					Whitings,	1	14	2	11	2	10		
					,,	139	5½–8	...	...	...	...		
					Gurnards,	5	10	9	9	2	8		
					,,	2	6	...	...	...	...		
					Gadus minutus,	4	5–5½	...	...	...	...		
Station XV. 10th May 1893. Shrimp-net. 8.50 p.m. to 9.30 p.m.	E. 9·3	46·8	45·9 22 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; young Decapod Crustacea, f.; very little in net.	Plaice,	1	15	...	...	...	...	*Hyas coarctatus*, r.; *Eupagurus prideauxi*, *E. bernhardus*, f.; *Asterias rubens*, c.; *Ophiura texturata*, r.; *Astro-*	At beginning — Wind W.S.W., force 3; weather, hazy, with rain; sea, slight; tide, 3¼ hours ebb; baro-
					Common dabs,	15	4–5	15	2-3	...	...		
					Solenettes,	2	4½	2	3½	26	2½–3½		
					Haddocks,	1	11½	3	6-7	...	...		
					Cod,	1	32	...	...	...	...		
					Whitings,	21	5–6½	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station XV. 10th May 1893. Shrimp-net. 8.50 p.m. to 9.30 p.m. —*continued.*					Gurnards, . .	1	7	10	5	7	2½–3½	*pecten irregularis*, r.; *Spatangus purpureus*, fr.; *Alcyonium*, sp. f.	meter, 30·23; transparency, 6½ fathoms.
					Pogges, . . .	7	4	4	3½	28	1½–2½		
Station XVI. 11th May 1893. Shrimp-net. 12.5 p.m. to 12.45 p.m.	S. 12·2	46·7	43·6 34 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; young Decapod Crustacea, fr.; young *Balani*, fr.; fish ova, f.	Lemon soles, .	1	17	1	13	1	6	*Pecten opercularis*, r.; *Pecten tigrinus*, f.; *Asterias rubens*, f.; *Goniaster phrygianus*, f.; *Echinus esculentus*, f.; *Filograna implexa*, fr.; *Actinoloba dianthus*, f.	At beginning—Wind W., force 2; weather, overcast; sea, slight; tide, 5¼ hours ebb; barometer, 30·14; transparency, 7 fathoms.
					Common dabs, .	2	7	7	5	12	4		
					,, ,, .	1	2	...	...	...	...		
					Long rough dabs,	1	8	12	5½	2	3½		
					,, ,, .	1	2	...	...	...	...		
					Halibut, . .	1	38	...	...	...	...		
					Haddocks, .	4	11	...	...	...	...		
					Dragonet, . .	1	8½	...	...	...	...		
Station I. 3rd Oct. 1893. 10 30 a.m. to 12.20 p.m.	W. 9·6	51·9	11·5 7½ fath.	Surface Tow-net.—*Hyperoche*, sp. f.; *Parathemisto*, sp. fr.; *Temora longicornis*, f.; Medusæ, f.; young Crustacea, c.	Thornback ray, .	1	11	...	...	...	...		At beginning — Wind W., force 1; weather, cloudy, with rain; sea, slight; tide, 5 hours ebb; barometer, 29·24; transparency, 3½ fathoms. At finish—Wind variable light; weather, cloudy; sea, slight; tide, ¾ hour flood; barometer, 29·23; transparency, 4 fathoms.
					Plaice, . .	10	20	19	14½–16	7	11½–13		
					,, .	3	9½	...	...	...	...		
					Common dabs, .	1	12	10	9–10	286	6–7		
					,, ,, .	2	4	...	...	...	...		
	E. 11·8	52·2	11·5 6½ fath.	Bottom Tow-net.—Contents similar to the surface net.	Solenette, . .	1	3	...	...	...	...		
					Long rough dabs,	2	7	...	...	...	...		
					Brill, . . .	1	13½	...	...	...	...		
					Haddocks, . .	4	9½	...	...	...	...		
					Cod, . . .	1	21	...	...	...	...		
					Gurnards, . .	1	14½	1	13	1	11½		
					.	7	6½	...	...	...	...		
					Angler, . .	1	27	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued*.

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station II. 3rd Oct. 1893. 7.0 a.m. to 9.15 a.m.	W. 6·7	51·8	11·9 13 fath.	Surface Tow-net.—*Hyperoche*, sp. f.; *Parathemisto*, sp. f.; *Calanus finmarchicus*, fr.; *Centropages*, sp. f.; Medusæ, fr.; *Tomopteris*, sp. fr.	Thornback rays,	1	25	2	18	1	15½		At beginning — Wind W. by S., force 1; weather, overcast, rain; sea, slight; tide, 1½ hours ebb; barometer, 29·23; transparency, 3½ fathoms. At finish — Wind S.W., force 1; weather, cloudy; sea, smooth; tide, 3¾ hours ebb; barometer, 29·24; transparency, 3½ fathoms.
					,, ,,	1	10	...	...	...	...		
					Starry ray,	1	5	...	...	...	...		
					Plaice,	3	25	3	2	6	14–15½		
					,,	3	12–13	8	10–11	9	9		
					,,	20	6	...	...	...	...		
	E. 10·1	51·7	11·8 18 fath.	Bottom Tow-net.—Hyperiidæ, f.; *Calanus finmarchicus*, c.; *Caligus*, sp. f.; *Sagitta*, sp. c.; young starfish, f.; *Carnuspira foliacea*, r.	Lemon soles,	2	7	1	6	...	...		
					Common dabs,	1	11	8	8	60	6		
					,, ,,	7	5	...	...	...	...		
					Witch soles,	2	18–19	9	16–17½	...	...		
					Long rough dabs,	4	12	3	10	14	8		
					,, ,,	7	6	...	...	...	...		
					Haddocks,	1	25	222	8–9	6	7		
					,,	1	4	...	...	...	...		
					Cod,	2	21	1	8	...	...		
					Whitings,	1	16½	19	11	8	8		
					,,	4	4	...	...	...	...		
					Gurnards,	1	16½	7	13	4	8		
					,,	12	6	...	...	...	..		
					Anglers,	1	22	1	10	...	...		
Station III. 5th Oct. 1893. 11.30 a.m. to 12.30 p.m.	W. 11·2	52·2	11·7 11 fath.	Surface Tow-net. — Ctenophora, fr.; young Crustacea, f.	Plaice,	2	21–23	9	14–15	47	11½–13	*Mytilus modiolus*, fr.; *Buccinum undatum*, f.; *Pecten opercularis*, f.; *Hyas coarctatus*, f.; *Portunus holsatus*, f.; *Asterias*, sp. f.;	At beginning—Wind W., force 2; weather, dull; sea, slight; tide, 2½ hours ebb; barometer, 29·10; transparency, 3 fathoms. At finish — Wind N.W., force 3;
					,,	7	9–10½	...	...	...	...		
	E. 9·8	51.2	11·7 8 fath.	Bottom Tow-net. — *Atylus*, sp. f.; *Pandalus annulicornis*, r.; broken weed, ab.	Lemon soles,	1	13½	3	11	1	10		
					,, ,,	1	9	...	...	...	...		
					Common dabs,	1	13	1	8	1	7		
					Haddock,	2	14	1	9	...	...		
					Cod,	2	27–34	2	18–23	2	13¼–16½		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station III. 5th Oct. 1893. 11.30 a.m. to 12.30 p.m. —*continued.*					Cod, . . .	5	10–11	...	...	...	...	*Solaster papposa*, f.; *Echinus esculentus*, fr.; *Strongylocentrotus drobachiensis*, f.; *Cucumaria*, f.; Zoophytes and weed, c.	weather and sea as before; tide, 3¼ hours ebb; barometer, 29·11; transparency, 3 fathoms.
					Gurnard, . .	1	7½	...	...	...	...		
Station IV. 6th Oct. 1893. 9.25 a.m. to 11.30 a.m.	S. 9·9	51·5	11·6 12½ fath.	Surface Tow-net.—*Parathemisto*, sp. fr.; *Calanus finmarchicus*, f.; *Centropages*, sp. f.; Ctenophora, fr.; young Crustacea, f.	Plaice, . .	2	25	3	18–19½	12	14–15½	*Cancer pagurus*, f.; *Asterias rubens*, fr.; Zoophytes and weed, f.	At beginning—Wind N.W., force 2; weather, cloudy; sea, slight; tide, high water; barometer, 29·28; transparency,
					,, . .	17	12–13½	32	10–11½	89	9		
					,, . .	247	7½	122	6½	...	...		
					Lemon soles, .	1	14½	1	13½	1	8		
					Common dabs, .	2	11	9	8½–9½	162	7½		
					,, ,, .	25	4½–6	...	...	...	...		
	S. 11·0	51·9	11·7 14½ fath.	Bottom Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Caligus*, sp. fr.; *Sagitta*, sp. fr.; *Tomopteris*, sp. r.; Medusæ, f.	Long rough dabs,	1	7½	...	...	...	...		At finish — Wind N.W., force 1; weather and sea as before; tide, 2 hours ebb; barometer, 29·32; transparency, 4½ fathoms.
					Brill, . .	1	19	...	...	...	...		
					Haddocks, . .	23	9½	1	13	52	8½		
					Whitings, . .	1	11	1	10	...	...		
					Gurnards, . .	1	13½	1	10	6	9		
					,, . .	16	5½–6½	...	...	...	...		
Station V. 6th Oct. 1893. 12.30 p.m. to 2.15 p.m.	W. 13·5	51·8	11·7 12½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Centropages*, sp. f.; *Hyperoche*, sp. r.; Ctenophora, fr.; young Crustacea, fr.	Thornback ray, .	1	15	...	...	...	...	*Cancer pagurus*, f.; *Asterias*, sp. fr.; *Solaster endeca*, f.; Ascidians, f.; *Alcyonium*, sp. f.; a small quantity of mud.	At beginning.—Wind W., force 1; weather, cloudy; sea, slight; tide, 3 hours ebb; barometer, 29·33; transparency, 4 fathoms. At finish—Wind, variable, light;
					Plaice, . .	1	19	2	15–16½	7	12–13½		
					,, . .	37	10–11½	80	9	95	7½		
					,, . .	7	6½	...	...	...	...		
					Lemon soles, .	1	10	1	9	4	7		
					,, ,, .	2	6	...	...	...	...		
	E. 10·2	52·4	11·8 17½ fath.	Bottom Tow-net.—*Parathemisto*, sp. f.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Caligus*,	Common dabs, .	1	12	1	11	9	9		
					,, ,, .	376	5½–7	...	...	...	...		
					Sail fluke, . .	1	19	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station V. 6th Oct. 1893. 12.30 p.m. to 2.15 p.m. —*continued.*				sp. fr.; *Sagitta*, sp. fr.; *Tomopteris*, sp. r.; Medusæ, f.	Long rough dabs,	5	7½	...	...	...	...		weather, cloudy, showery; sea, slight easterly swell; tide, 4¾ hours ebb; barometer, 29·36; transparency, 5 fathoms.
					Haddocks, . .	1	15	47	89	...	...		
					Cod, . . .	1	22	1	12	...	...		
					Gurnards, . .	4	10–11½	1	13½	29	7		
Station VI. 6th Oct. 1893. 3.15 p.m. to 5.15 p.m.	E. 9·8	52·3	11·8 17 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Centropages*, sp. f.; *Parathemisto*, sp. f.; Ctenophora, f.; young Crustacea, fr.	Thornback rays,	2	16–17	...	...	...	...	*Eupagurus bernhardus*, (r.; *Asterias rubens*, fr.; *Luidii sarsii*, r.; Zoophytes, f.	At beginning — Wind, variable, light; weather, cloudy, showery; sea, slight easterly swell; tide, 5¾ hours ebb; barometer, 29·37; transparency, 3½ fathoms. At finish—Wind W.S.W., light; weather, cloudy; sea as before; tide, 1½ hours flood; barometer, 29·41; transparency, 3½ fathoms.
					Plaice, . .	3	16½–19	4	14–15½	16	12–13		
					,, . .	54	10–11½	182	8½	161	5½–6½		
					Lemon soles, .	1	15	1	13	1	9		
					,, ,, .	6	6-7	...	...	...	...		
					Common dabs, .	2	11–12	9	9–10	66	7		
	W. 9·1	51·9	11·2 8 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Sagitta*, sp. f.; Medusæ, f.	,, ,, .	333	5–6	...	...	...	...		
					Solenette, . .	1	3	...	...	...	...		
					Haddocks, . .	10	9½	4	8	...	...		
					Gurnards, . .	3	11	11	8	31	6		
					,, . .	12	5	...	...	...	...		
					Anglers, . .	1	26	1	15	...	...		
Station VII. 7th Oct. 1893. 7.5 a.m. to 8.50 a.m.	W. 8·9	52·8	11·8 24½ fath.	Surface Tow-net.—*Idotea pelagica*, r.; *Hyperoche*, f.; *Hyperia*, r.; Medusæ (small), c.	Plaice, . .	1	21½	4	13–14½	3	11–12	*Eledon cirrhosa*, r. (juv.); *Eupagurus prideauxi*, r.; Ascidians, f.; *Hyas coarctatus*, r.;	At beginning— Wind N.W., force 2; weather, cloudy; sea, slight easterly swell; tide, 3 hours flood; barometer,
					Lemon sole, .	1	5½	...	...	...	...		
					Common dabs, .	1	9	32	8	96	6½		
	E. 10·2	53·0	11·7 31 fath.	Bottom Tow-net.—*Calanus finmarchicus*, r.;	,, ,, .	93	5½	...	...	...	...		
					Witch soles, .	3	13–14½	3	11	2	9		
					Long rough dabs,	25	7	32	6	3	4½		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn. and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather and other Observations.
Station VII. 7th Oct. 1893. 7.5 a.m. to 8.50 p.m. —*continued.*				*Caligus*, sp. fr.; *Sagitta*, sp. f.; *Tomopteris*, sp. f.; small Medusæ, fr.	Haddocks, . .	1	17½	1	15½	5	14–13½	*Asterias rubens*, f.	29·53; transparency, 5 fathoms. At finish –Wind, weather and sea as before; tide, 4¾ hours flood; barometer, 29·56; transparency, 7½ fathoms.
					,, . .	3	10–11	375	7–8½	...	...		
					Cod, . .	1	15½	1	9	...	...		
					Whitings, . .	4	12	7	8	...	...		
					Gurnards, . .	1	18½	4	16	11	11½–13		
					,, . .	20	6–6½	...	...	...	...		
					Hake, . .	1	15	...	...	...	...		
					Dragonets, . .	4	5	...	...	...	...		
Station VIII. 10th Oct. 1893. 1.5 p.m. to 2.45 p.m.	N. 9·5	53·0	11·4 34 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Centropages*, sp. f.; Medusæ (small), fr.	Plaice, .	1	17	...	...	...	...	*Asterias*, sp. f.; *Goniaster equestris*, r.; *Cucumaria*, sp. (large, dark coloured), f.	At beginning—Wind N.W. by W., force 6; weather, cloudy; sea, choppy; tide, 1 hour ebb; barometer, 29·53; transparency, 8 fathoms. At finish—Wind W.N.W., force 6; weather and sea as before; tide, 2¾ hours ebb; barometer, ; transparency, .
					Lemon soles, .	2	17½	2	15–16½	1	10½		
					,, ,, .	1	8	...	...	...	...		
					Common dabs, .	12	8	23	6½	...	...		
	S. 9·7	54·0	11.3 34 fath.	Bottom Tow-net.—*Spirialis retroversus*, f.; *Clione borealis*, r.; *Hyperidæ*, r.; *Calanus finmarchicus*, f.; *Centropages*, sp. f.; *Caligus*, sp. fr.; *Sagitta*, sp. f.; small Medusæ, ab.; young starfish, r.; young Crustacea, f.; young lumpsucker, l.	Witch soles, .	2	16½–20	2	14	4	11–12½		
					,, ,, .	4	8–9½	...	...	...	...		
					Long rough dabs,	1	9½	29	7½	22	6		
					,, ,,	3	5	...	...	...	...		
					Haddocks, . .	1	12	2	11	88	8		
					,, . .	17	7	...	...	...	...		
					Whiting, . .	1	11	...	...		...		
					Ling, . . .	2	34	...	...	..	...		
					Gurnards, . .	2	16½–17	1	15	4	10		
					,, . .	7	6½–8	...	...	...	...		
					Brassie, . .	2	7	...	...	...	...		
					Hake, . .	1	14	...	...	...	...		
					Angler, . .	1	26½	...	...	...	..		
Station IX. 10th Oct. 1893. 10.15 a.m. to 12 noon.	N. 10·0	52·9	11·3 30½ fath.	Surface Tow-net. — Medusæ (small), fr.; *Calanus finmarchicus*, f.	Plaice, .	1	12	...	...	...	...	*Pecten opercularis*, r.; Ascidians, f.; *Asterias*, sp. f.; *Actinoloba dianthus*, fr.	At beginning—Wind N.W. by W., force 2; weather overcast; sea moderate; tide, hours flood; barometer, 29·56; transparency, 7¾ fathoms.
					Lemon soles, .	1	8½	...	...	...	...		
					Common dabs, .	11	9–9½	57	7½	86	5–6½		
	S 11·5	52·8	11·4 35 fath.	Bottom Tow-net.—*Metopa*, sp. r.; *Calanus finmarchicus*, f.; *Thalestris*	Witch sole, .	1	10	...	...	...	...		
					Long rough dabs,	14	8½	24	6½	8	5		
					Haddocks, . .	19	8½–9½	3	8	1	4½		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth.—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl net.	Wind, Weather, and other Observations.
Station IX. 10th Oct. 1893. 10.15 a.m. to 9.5 p.m. —*continued.*				*serralatus*, r.; Medusæ (small), f.	Cod, . . .	1	10½	...	...	...	...		At finish — Wind N.W. by W., force 6; weather, cloudy; sea, choppy; tide, high water; barometer, 29·54; transparency, 8 fathoms.
					Whiting, . .	1	8½	...	...	...	...		
					Gurnards, . .	14	9–10	2	8½	24	6½		
					Pogge, . .	1	4½	...	...	.	...		
Station X. 2nd Oct. 1893. 2.0 p.m. to 4.5 p.m.	S.E. 14·8	53·3	11·2 14½ fath.	Surface Tow-net.—*Hyperoche*, sp. f.; Small Medusæ, fr.; young Crustacea, f.	Starry ray, .	1	15	...	...	...	...	*Pecten opercularis*, f.; Zoophytes and *Alcyonium*, sp. f.	At beginning—Wind S.S.W., force 2; weather, cloudy; sea, slight; tide, 3¼ hours flood; barometer, 29·39; transparency, 4½ fathoms. At finish—Wind S., force 2; weather and sea as before; tide, 5¼ hours flood; barometer, 29·35 transparency, 4; fathoms.
					Sandy ray, .	1	15½	...	...	...	...		
					Plaice, . .	2	19½–22	4	16–18½	2	14–15½		
					,, . .	3	12½–13½	...	...	...	...		
	N.W. 12·9	53·0	11·5 25 fath.	Bottom Tow-net. — *Spirialis retroversus*, fr.; *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; small Medusæ, fr.; young starfish, f.	Lemon soles, .	2	16-18	2	12–14	3	9–11		
					,, ,, .	3	5½–6½	...	...	...	...		
					Common dabs, .	2	9–10	9	7	51	6		
					,, ,, .	7	5	...	...	. .	...		
					Haddocks, . .	3	10½	14	9½	8	8		
					Cod, . . .	2	16–17½	1	11	1	9		
					,, . .	1	7½	...	...	...	...		
					Whiting, . .	1	11½	...	...	...	...		
					Gurnards, . .	2	15½	5	12½	8	9½		
					,, . .	23	5–7	...	...	...	...		
					Anglers, . .	2	25–34	1	23	1	14		
Station XI. 16th Oct. 1893. 11.30 a.m. to 1.30 p.m.	W. 12·2	52·5	11·3 22 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Centropages*, sp. fr.; *Sagitta*, sp. f.; small Medusæ, c.	Plaice, . .	2	19–20	8	17–18	12	15–16	*Pecten opercularis*, f.; *Mytilus modiolus*, f.; *Eupagurus bernhardus*, f.; *Asterias*, sp. fr.; *Astropecten irregularis*, f.; *Ech-*	At beginning—Wind S.S.W., force 2; weather, cloudy; sea, slight north-easterly swell; tide, 2½ hours flood; barometer, 29·50; transparency, 9 fathoms.
					Lemon soles, .	1	17	1	15½	2	8		
					Common dabs, .	2	11–14	4	9	28	7		
					,, ,, .	83	5–6	...	...	...	...		
					Solenette, . .	1	3	...	...	...	...		
	E. 12·9	52·3	11·0 23 fath.	Bottom Tow-net. — *Ægirus*, sp. r.; *Calanus*	Haddocks, . .	3	10	43	9	4	8		
					Whitings, . .	1	14	1	8½	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station XI. 16th Oct. 1893. 11.30 a.m. to 1.30 p.m. —*continued.*				*finmarchicus*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Caligus*, sp. fr.; *Sagitta*, sp. f.; small Medusæ, f.	Gurnards, . .	2	12½–13½	4	10–11	17	7½	*inus esculentus*, *E. miliaris*, f.; *Cucumaria*, sp. (large, dark coloured) f.; *Alcyonium*, sp. fr. (large).	At finish—Wind W. by S., force 3; weather and sea as before; tide, 4½ hours flood; barometer 29·49; transparency, 9 fathoms.
					,, . .	5	6½	...	...	...	...		
Station XII. 16th Oct. 1893. 2.20 p.m to 4.25 p.m.	N. 11·5	52·5	11·2 24½ fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Parathemisto*, f.; small Medusæ, c.	Plaice, . .	1	25½	3	20½–22	12	18–19½	*Pecten opercularis*, f.; *Buccinum undatum*, f.; *Fusus propinquus*, r.; *Loligo*, sp. r.; *Asterias*, sp. f.; *Echinus esculentus*, f.; *Cucumaria*, sp. f.; *Alcyonium*, sp. fr.	At beginning—Wind W. by S., force 3; weather, overcast; sea, slight north-easterly swell; tide, 5½ hours flood; barometer, 29·49; transparency, 9½ fathoms.
					,, . .	9	15½–17	...	...	...	...		
					Lemon sole, .	1	13	...	...	...	...		
					Common dabs, .	11	8	27	5½–6	...	...		
	S. 11·5	52·3	11·1 25 fath.	Bottom Tow-net.—*Hyperidæ*, r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Caligus*, sp. f.; *Sagitta*, sp. f.; small Medusæ, f.	Haddocks, .	1	27½	1	17	6	12–13½		At finish—Wind W., force 3; weather, rain; sea as before; tide, 1½ hours ebb; barometer, 29·52; transparency, 9 fathoms.
					,, . .	70	8½–10	...	...	...	...		
					Cod, . . .	1	25	2	15–16	4	11–12		
					,, . . .	1	10	...	...	...	...		
					Whiting, . .	1	9½	...	...	...	...		
					Ling, . . .	1	34	.	...	...	...		
					Gurnards, . .	8	13–13½	12	10½	5	9½		
					Gadus minutus,	1	4	...	...	...	...		
					Angler, . .	1	25½	...	...	...	...		
Station XIII. 17th Oct. 1893. 2.20 p.m. to 4.5 p.m.	N. 12·0	52·4	11·0 25 fath.	Surface Tow-net.—*Spirialis retroversus*, f.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Acartia*, sp. f.; small Medusæ, fr.	Plaice, . .	5	18–19½	4	16–17	1	15	*Pecten opercularis*, f.; *Asterias*, sp. f.; *Luidia savigny*, 1; *Goni-*	At beginning—Wind E. by N., force 1; weather, cloudy; sea, north-easterly swell; tide, 3¾ hours flood; barometer, 29·92;
					Lemon soles, .	10	16–17½	8	13½–15	10	10–11		
					,, ,, .	7	9	...	...	...	...		
					Common dabs, .	4	7	16	4½–5½	...	...		
					Long rough dabs,	2	6	...	...	...	...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Sur. face.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Fish. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather, and other Observations.
Station XIII. 17th Oct. 1893. 2.20 p.m. to 4.5 p.m. —*continued.*	S. 12·3	52·2	11·0 24½	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Caligus*, sp. f.; *Sagitta*, sp. r.; *Tomopteris*, sp. r.; young Crustacea, r.	Haddocks, . . ,, . . Cod, . . Gurnards, . .	3 13 2 1	13–14 8½ 18–19 11	1 ... 2 2	10 ... 12–13 8	13 ... 2 ...	9½ ... 10–11 ...	*aster equestris*, r.; *Cancer pagurus*, r.; *Echinus esculentus*, fr.; *Alcyonium*, sp. fr.	transparency, 11½ fathoms. At finish—Wind, weather and sea as before; tide, 5½ hours flood; barometer, 29·97: transparency, 11¼ fathoms.
Station XIV. 17th Oct. 1893. 11.0 a.m. to 12.45 p.m.	N. 9·4	52·3	11·0 31½ fath.	Surface Tow-net.—*Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Centropages*, sp. f.; *Caligus*, sp. r.; small Medusæ, f.; young *Motella*, sp. r.	Grey skate, . Starry rays, . Plaice, . Lemon soles, . Common dabs, . Long rough dabs,	1 1 1 2 10 10	33 12½ 17½ 9 7½ 6	... 1 1 3 24 ...	... 5 14 7½ 5–6 ...	... ... 3	... ... 6	*Cancer pagurus*, r.; *Eledon cirrhosa*, r.; *Asterias*, sp. f.; *Astropecten irregularis*, f.; *Solaster papposa*, f.; *Ophiura texturata*, f.; *Cucumaria*, sp. f.	At beginning—Wind E. by N., force 1; weather, cloudy; sea, north-easterly swell; tide, 1 hour flood; barometer, 29.91; transparency, 12 fathoms.
	S. 12·0	52·3	11·0 40½ fath.	Bottom Tow-net.—*Erythrops*, sp. r.; *Calanus finmarchicus*, f.; *Centropages*, sp. f.; *Sagitta*, sp. f.; small Medusæ, fr.	Haddocks, . Cod, . Whitings, . Gurnards, . ,, . Pogge, .	7 2 3 1 9 1	10–11 12–12½ 15–16½ 15½ 7½ 4½	8 ... 4 1	8½–8½ ... 12½–13 13½	... ... 1 1	... ... 11 10		At finish—Wind, weather and sea as before; tide, 2¾ hours flood; barometer, 29.93; transparency, 12 fathoms.
Station XV. 16th Oct. 1893. 8.35 a.m. to 10.35 a.m.	S. 11·4	52·2	11·1 25½ fath.	Surface Tow-net damaged.	Plaice, . Lemon soles, . ,, ,, .	4 1 14	18–19 16 7	7 4 ...	16–17 14–15 ...	6 14 ...	14–15 9 ...	*Pecten maximus*, r.; *Pecten opercularis*, several; *Buccinum undatum*, f.; *Fusus antiquus*, f.; Ascidians, f.; *Asterias*, sp. f.; *Goniaster equestris*, r.;	At beginning—Wind S.W. by S., force 2; weather, cloudy; sea, slight; tide, 5¾ hours ebb; barometer, 29·53; transparency, 9 fathoms.
	N. 11·9	52·3	11·1 29 fath.	Bottom Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, fr.; *Centropages*, sp. f.; *Caligus*, sp. fr.; *Sagitta*, sp. r.;	Common dabs, . Haddocks, . ,, . Cod, . ,, .	34 1 13 1 1	8 21 12 19 8	128 1 54 4 ...	6½ 18 10 11–12 ...	33 11 28 1 ...	5 13–14 9 10 ...		

TABLE C.—Record of Observations made on Board the 'Garland' during 1893.—V. Moray Firth—*continued.*

Station Date, and Time Trawl down.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Pelagic Fauna, Spawn, and young Fish.	Description of Take.	Number and Size of Size. No.	Inches	No.	Inches	No.	Inches	Invertebrate Fauna, &c., brought up in Trawl Net.	Wind, Weather and other Observations.
Station IX. 16th Oct. 1893. 8.35 a.m. to 10.35 a.m. —*continued.*				small Medusæ, r.; young Crustacea, r.	Gurnards,	2	11½–13	5	10	26	7	*Luidii savigny*, 7 specimens; *Echinus esculentus*, f.; *Spatangus purpureus*, f.; *Cucumaria*, sp. (large, dark coloured), f.; *Alcyonium*, sp. fr.	At finish—Wind S.S.W., force 2; weather and sea as before; tide 1½ hours flood; barometer, 29·51; transparency, 9 fathoms.
					,,	1	5½	...	...	...	...		
					Anglers,	1	36	2	27	2	24		
					Dragonets,	2	7	1	6	...	...		
Station X. 17th Oct. 1893. 5.35 p.m. to 7.20 p.m.	N. 10·0	52·2	11·0 35 fath.	Surface Tow-net.—*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages*, sp. f.	Thornback ray,	1	26	...	...	...	...	*Pecten opercularis*, fr.; *Buccinum undatum*, f.; *Mytilus modiolus*, f.; *Loligo*, sp. f.; *Portunus*, sp. fr.; *Eupagurus*, f.; *Asterias*, sp. c.; *Goniaster equestris*, r.; *Echinus esculentus*, c.; *Cucumaria*, sp. f.	At beginning—Wind N. by E., force 1; weather, cloudy; sea, north-easterly swell; tide, 1¼ hours ebb; barometer, 29·96; transparency, 8 fathoms. At finish—Wind N.E. by E., force 1; weather and sea as before; tide, 3 hours ebb; barometer, 29·99; transparency (too dark to see).
					Starry ray,	3	11½	...	...	...	...		
					Plaice,	1	19¼	1	18¾	1	14½		
					,,	1	12½	...	...	...	...		
	S. 10·0	52·0	11·0 29 fath.	Bottom Tow-net.—*Sirella*, sp. f.; Amphipods (*Hippomedon*, &c.), several; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Sagitta*, sp. c.; small Medusæ, f.; young Crustacea, f.	Lemon soles,	3	17½	1	12½	4	9–10½		
					,, ,,	3	7	...	...	...	...		
					Common dabs,	2	8	26	7	28	6		
					,, ,,	7	5	...	...	...	...		
					Haddocks,	3	18–19	5	15–16¼	18	13–14½		
					,,	16	12	36	10	214	9		
					,,	36	8	...	...	...	...		
					Cod,	2	21½–22½	2	17–19½	2	14–15		
					,,	5	12	1	8	...	...		
					Whitings,	1	15½	2	12	2	8		
					Brassie,	3	6	2	4	...	...		
					Gurnards,	10	14	14	12	10	10		
					,,	39	6½–8	...	...	...	...		
					Anglers,	1	46	1	32	1	28½		

TABLE D.—ANSTRUTHER DISTRICT.—Buckhaven Haddock and Cod Line Fishing—Years 1892-93.

Months.	1892.								1893.							
	Number of Days Boats were out per Month.	Total Number of Shots per Month.	Haddocks and Whitings.		Number of Cod.	Average Number of Fish per Shot.			Number of Days Boats were out per Month.	Total Number of Shots per Month.	Haddocks and Whitings.		Number of Cod.	Average Number of Fish per Shot.		
			100's of Large.	100's of Small.		Haddocks and Whitings.		Cod.			100's of Large.	100's of Small.		Haddocks and Whitings.		Cod.
						Large.	Small.							Large.	Small.	
January, . .	18	131	59	16	377	57·64	15·63	2·87	23	182	96	12	213	67·5	8·4	1·17
February, . .	24	239	108	89	319	57·84	47·66	1·33	15	82	34	16	159	53·1	25·0	1·94
March, . . .	26	355	112	141	327	40·38	50·83	0·92	22	127	44	29	224	44·4	29·2	1·76
April, . . .	26	326	40	159	–	15·705	62·42	–	25	273	127	248	128	59·5	116·3	0·47
May, . . .	26	211	156	86	–	94·63	53·68	–	27	328	52½	468	–	20·5	182·6	–
June, . . .	25	229	149	52	–	83·28	29·06	–	24	202	176¾	46	–	112·0	29·1	–
July, . . .	24	210	159	277	–	96·91	168·83	–	24	172	191¼	1164¾	–	142·3	866·8	–
August, . .	23	201	50	301	36	31·84	191·68	0·17	26	200	69¾	691¼	–	44·6	442·4	–
September, . .	23	285	65	251	–	29·19	112·73	–	23	199	49	671	18	31·5	431·6	0·09
October, . .	22	482	120	232	10	31·86	61·61	0·02	24	481	69½	990	343	18·5	263·4	0·71
November, . .	20	264	92	180	139	44·606	87·27	0·52	21	448	45¼	1231	839	12·9	351·8	1·87
December, . .	27	179	109	86½	183	77·94	60·402	1·02	22	407	71	1437	1203	22·3	451·9	2·95
Totals for Year,	284	3112	1219	1870½	1391	50·13	76·93	0·44	276	3101	1026	7004	3127	42·7	289·4	1·008

Note.—'Large' fish are Haddocks only; 'Small' includes Whitings and (principally) Small Haddocks. One hundred fish is 32 warp or 128 fish. The total number of shots per month is ascertained by adding together the number of boats out each day.

TABLE E.—Showing the Monthly Takes of Line and Net Boats from Inshore Grounds in the Leith, Anstruther, Montrose, and Stonehaven Districts.

I. LEITH DISTRICT. North Berwick.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (18)	122½	1·924	20	0·322	8	0·13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	62	...	...	...
Feb. (19)	465½	6·376	7	0·096	7	0·096	...	...	...	...	...	...	2½	0·034	...	...	1	0·0137	...	...	73	18 to 23 ft.	...	...
Mar. (14)	...	...	8	0·32	4	0·16	...	...	...	...	...	...	9½	0·38	...	...	...	...	...	...	25	20 ft.	...	...
Apr. (24)	...	...	81½	0·36	182½	0·807	1½	0·0066	...	...	...	...	27½	0·121	...	...	½	0·0022	...	...	226	18 to 23 ft.	7	50 ft.
May (27)	...	...	58½	0·2	335	1·135	17	0·058	...	...	...	...	17	0·058	...	...	27	0·091	...	...	295	18 to 23 ft.	...	...
June (25)	3½	0·0133	43	0·164	258	0·985	56	0·213	...	...	...	...	21½	0·082	...	...	39	0·149	...	...	262	...	...	...
July (25)	...	...	39	0·212	138	0·75	26½	0·144	...	...	...	...	15½	0·084	...	...	9	0·049	...	...	184	18 to 23 ft.	...	...
Aug. (24)	...	...	25	0·296	53	0·631	21½	0·256	...	...	...	...	7½	0·089	...	...	3½	0·0416	...	...	84	19 to 23 ft.	...	...
Sept. (23)	...	...	19½	0·3	31	0·477	4½	0·069	...	...	...	...	7½	0·115	...	...	2	0·031	...	...	65	19 to 23 ft.	...	...
Oct. (23)	...	...	21	0·28	56	0·746	14½	0·18	...	...	...	...	7	0·0933	...	...	...	...	...	...	75	19 to 23 ft.	1	53 ft.
Nov. (15)	...	...	16	0·421	28	0·737	8½	0·223	...	...	...	...	½	0·013	...	...	...	...	...	...	38	...	...	...
Dec. (20)	185½	2·576	19	0·264	28	0·39	1	0·014	...	...	...	...	1½	0·0283	...	...	...	...	...	...	72	19 to 23 ft.	...	...
Total for year	777	0·531	357½	0·244	1128½	0·772	151	0·103	...	...	...	...	117½	0·08	...	...	82	0·056	...	...	1461		8	

TABLE E.—I. LEITH DISTRICT—*continued.* COCKENZIE AND PORTSETON.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
	Cwts.	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
1893. Jan. (22)	...	...	328	1·312	334	1·336	...	...	...	...	...	...	17	0·068	...	...	..	...	...	...	250	...	...	...
Feb. (19)	...	...	141	0·953	145	0·98	2	0·0135	...	...	...	...	10	0·067	...	...	...	...	...	...	148	...	...	...
Mar. (25)	...	...	239	1·122	140	0·657	...	...	...	...	...	...	59½	0·279	...	...	...	...	...	...	213	...	...	...
Apr. (25)	...	...	180	0·774	111	0·66	...	...	...	...	...	...	54½	0·324	...	...	...	...	...	...	168	...	...	...
May (26)	...	...	49	0·347	126	0·893	15	0·106	...	...	...	...	53½	0·38	...	...	...	...	...	...	141	...	...	...
June (25)	...	...	32	0·288	66½	0·599	15½	0·139	...	...	...	...	30	0·27	...	...	...	...	...	...	111	...	...	...
July (25)	...	...	14	0·113	82	0·661	28½	0·23	...	...	...	...	56	0·451	...	...	...	...	...	...	124	...	...	...
Aug. (27)	...	...	17	0·129	92	0·697	17	0·129	...	...	...	...	59	0·447	...	...	...	...	...	...	132	...	...	...
Sept. (22)	...	...	59	0·421	179	1·278	26	0·186	...	...	...	...	64½	0·46	...	...	...	...	...	...	140	22 to 32 ft.	...	...
Oct. (23)	...	...	396	1·226	288	0·891	48	0·148	...	...	...	...	145	0·449	...	...	...	...	...	...	323	25 to 30 ft.	...	...
Nov. (25)	...	...	541½	1·265	390	0·911	25	0·58	...	...	...	...	106½	0·248	...	...	...	...	...	...	428	...	...	...
Dec. (26)	...	...	755	1·457	574	1·108	7	0·0135	...	...	...	...	45	0·087	...	...	...	...	...	...	518	...	...	...
Total for year	...	...	2701½	1·04	2527½	0·937	184	0·068	...	...	...	...	700½	0·26	...	...	...	...	...	...	2696			

TABLE E.—I. LEITH DISTRICT—*continued.* FISHERROW.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																				Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (21)	642	6·356	794	7·861	18	0·178	...	...	...	...	...	...	...	...	...	...	25	0·247	17	0·168	101	23 to 31 ft.	60	45 to 58 ft.
Feb. (14)	269	5·977	16	0·355	9	0·2	...	...	...	...	...	...	70	1·555	...	...	...	...	...	...	45	25 to 35 ft.	69	42 to 58 ft.
Mar. (18)	4	0·043	34	0·369	14	0·152	...	...	...	...	...	...	197	2·032	...	...	...	...	12	0·13	92	23 to 30 ft.	78	33 to 58 ft.
Apr. (20)	...	...	78	0·678	97	0·843	...	...	...	...	...	...	136	1·182	...	...	...	...	27	0·235	115	23 to 33 ft.	52	44 to 58 ft.
May (17)	...	...	46	0·561	73	0·89	9	0·109	...	...	...	...	68	0·829	...	...	...	...	13	0·158	82	22 to 26 ft.	29	44 to 58 ft.
June (11)	...	...	13	0·541	22	0·915	...	...	...	...	...	...	24	1·00	..	...	...	...	...	...	24	22 to 28 ft.	11	38 to 60 ft.
July (11)	...	...	9	0·818	5	0·454	...	...	...	...	...	...	8	0·727	...	...	...	...	...	...	11	22 to 33 ft.	...	...
Aug. (14)	...	...	7	0·466	11	0·733	...	...	...	...	...	...	32	2·133	...	..	...	...	...	...	15	22 to 28 ft.	...	...
Sept. (10)	...	...	8	0·4	26	1·3	...	...	...	...	...	...	30	1·5	...	...	...	...	...	...	20	22 to 32 ft.	10	44 to 58 ft.
Oct. (21)	...	...	35	0·714	20	0·408	...	...	...	...	...	...	79	1·612	...	...	...	...	...	...	49	22 to 33 ft.	37	49 to 58 ft.
Nov. (16)	...	...	137	3·116	91	1·516	6	0·1	...	...	...	...	37	0·616	...	...	48	0·8	15	0·25	60	27 to 40 ft.	28	49 to 58 ft.
Dec. (20)	695	4·484	791	5·103	242	1·561	21	0·135	...	...	...	...	28	0·18	...	...	79	0·509	36	0·232	155	22 to 34 ft.	...	...
Total for year	1610	2·093	2018	2·624	628	0·816	36	0·047	...	...	...	...	709	0·922	...	...	152	0·197	120	0·156	769		374	

TABLE E.—I. Leith District—*continued.* Newhaven.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (15)	...	...	589	8·662	...	...	...	...	...	...	...	...	...	...	...	...	65	0·956	49	0·726	68	26 to 50 ft.	45	48 to 50 ft.
Feb. (17)	...	...	135	4·821	15	0·535	...	...	...	...	...	...	9½	0·34	...	...	15	0·535	5	0·178	28	16 to 50 ft.	106	48 to 50 ft.
Mar. (19)	...	...	159	1·766	14	0·155	...	...	...	...	...	...	42½	0·472	...	...	16	0·177	22	0·244	90	16 to 50 ft.	33	48 to 50 ft.
Apr. (18)	...	...	105	1·346	23½	0·301	...	...	...	...	...	...	42	0·538	...	...	14	0·179	25½	0·327	78	16 to 50 ft.	90	45 to 50 ft.
May (18)	...	...	8	0·154	13	0·25	...	...	...	...	...	...	92	1·779	...	...	26	0·5	...	...	52	16 to 25 ft.	177	45 to 50 ft.
June (16)	...	...	6	0·107	17	0·304	...	...	...	...	...	...	57	1·018	...	...	36	0·643	...	...	56	16 to 25 ft.	133	45 to 60 ft.
July (16)	...	...	10	0·303	16	0·485	...	...	...	...	...	...	52½	1·591	...	...	1	0·0303	...	...	33	16 to 25 ft.	36	45 to 60 ft.
Aug. (20)	...	...	3	0·0491	7	0·115	...	...	...	...	...	...	100	1·639	...	...	...	...	...	...	61	16 to 25 ft.	15	60 ft.
Sept. (13)	...	...	4	0·1212	2	0·0606	...	...	...	...	...	...	38	1·151	...	...	...	...	...	...	33	16 to 25 ft.	34	45 to 60 ft.
Oct. (18)	...	...	66	1·32	30	0·6	...	...	...	...	...	...	18½	0·37	...	...	12	0·24	5	0·1	50	16 to 48 ft.	67	48 to 60 ft.
Nov. (19)	...	...	714	4·924	15	0·103	...	...	...	...	...	...	3½	0·024	...	...	109	0·751	48	0·331	145	16 to 50 ft.	31	48 to 60 ft.
Dec. (16)	6181	87·056	560	7·887	...	...	...	...	...	...	...	...	...	...	...	...	47½	0·669	42	0·591	71	25 to 50 ft.	42	48 to 50 ft.
Total for year	6181	8·079	2359	3·084	152½	0·199	...	...	...	...	...	...	455½	0·595	...	...	341½	0·446	196½	0·256	765		809	

TABLE E.—II. ANSTRUTHER DISTRICT. LARGO.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (22)	...	...	70	0·46	82	0·539	...	...	...	...	...	...	87	0·567	..	...	...	...	...	...	152	18 to 25 ft.	...	...
Feb. (22)	...	...	45	0·258	34	0·195	..	...	...	...	...	...	293	1·684	...	...	...	...	...	...	174	15 to 25 ft.	...	...
Mar. (27)	...	...	35	0·178	11	0·0561	...	...	...	...	...	...	203	1·036	...	...	...	...	...	...	196	15 to 25 ft.	...	...
Apr. (25)	...	...	21	0·176	144	1·217	...	...	...	...	...	...	14	0·117	...	...	...	...	...	...	119	18 to 24 ft.	...	48 to 51 ft.
May (27)	...	...	49	0·302	102	0·63	...	...	...	...	...	...	...	...	..	...	...	...	...	...	162	15 to 24 ft.	...	48 to 51 ft.
June (25)	...	...	24	0·144	74	0·443	...	...	...	...	...	...	...	...	...	...	...	...	...	...	167	15 to 24 ft.	...	48 to 51 ft.
July (26)	...	...	7	0·127	55	1·00	...	...	...	...	...	...	...	...	...	...	...	...	...	...	55	18 to 20 ft.	...	...
Aug. (26)	...	...	9	0·163	57	1·036	...	...	...	...	...	...	...	...	...	...	...	...	...	...	55	18 to 20 ft.	...	...
Sept. (26)	...	...	11	0·044	258	1·044	...	...	...	...	...	...	65	0·263	23	0·093	...	...	...	...	247	14 to 24 ft.	...	...
Oct. (26)	...	...	30	0·096	426	1·36	...	...	...	...	...	...	45	0·143	...	...	...	...	...	...	313	15 to 25 ft.	...	...
Nov. (24)	...	...	100	0·346	528	1·827	...	...	...	...	...	...	19	0·066	...	...	...	...	...	...	289	15 to 25 ft.	...	...
Dec. (20)	...	...	94	0·417	399	1·773	...	...	...	...	...	...	...	...	...	...	...	...	...	...	225	15 to 25 ft.	...	...
Total for year	...	...	495	0·229	2170	1·007	...	...	...	...	...	...	726	0·337	23	0·01	...	...	...	...	2154			

TABLE E.—II. ANSTRUTHER DISTRICT—*continued.* ELIE AND EARLSFERRY.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.										Number of Trips and Size of Boats Fishing.			
	Herring.	Cod.	Haddock.	Whiting.	Lemon Soles.	Turbot and Brill.	Plaice and Flounders.	Dabs.	Skate.	Other White Fish.	Within the Territorial Waters.		Beyond the Territorial Waters.	
	Cwts. Aver.	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*No.*	*Size.*	*No.*	*Size.*
1893. Jan. (19)	7⅞ 0·148	12 0·226	23¼ 0·438	... ...	... ...	... ...	... ...	... ...	... ...	... ...	53	16 ft.	...	...
Feb. (17)	441 6·111	39¼ 0·545	22½ 0·309	... ...	... ...	... ...	7½ 0·1	... ...	... ...	... ...	72	16 to 57 ft.	...	...
Mar. (20)	... ...	8 0·117	14⅓ 0·209	... ...	... ...	... ...	13½ 0·198	... ...	... ...	... ...	68	16 ft.	...	...
Apr. (25)	... ...	26 0·26	71⅜ 0·717	... ...	... ...	... ...	... ...	... ...	... ...	29¾ 0·297	100	16 ft.	...	...
May (27)	... ...	16¾ 0·154	29 0·268	30⅛ 0·282	... ...	... ...	... ...	... ...	.. ...	51⅜ 0·479	108	16 ft.	...	...
June (25)	... ...	10½ 0·14	52½ 0·7	5 0·066	... ...	... ...	3¼ 0·043	... ...	... ...	61¾ 0·823	75	16 ft.	...	...
July (25)	... ...	36½ 0·42	59 0·678	11⅜ 0·135	... ...	... ...	12½ 0·144	4½ 0·051	... ...	64 0·735	87	18 to 28 ft.	...	...
Aug. (27)	... ...	28¼ 0·261	58⅜ 0·544	10¼ 0·095	... ...	... ...	2¼ 0·02	... ...	... ...	... ...	108	16 ft.	...	...
Sept. (23)	... ...	19½ 0·281	41¼ 0·597	4⅜ 0·069	... ...	... ...	3¾ 0·054	... ...	... ...	... ...	69	16 ft.	...	...
Oct. (19)	... ...	19½ 0·342	52⅜ 0·925	4½ 0·079	... ...	... ...	2¾ 0·048	... ...	... ...	... ...	57	16 ft.	...	...
Nov. (20)	... ...	16¾ 0·279	60 1·00	5 0·083	... ...	... ...	3⅓ 0·058	... ...	... ...	... ...	60	16 ft.	...	...
Dec. (20)	... ...	30¼ 0·432	68 0·983	5¼ 0·075	... ...	... ...	3½ 0·05	... ...	... ...	... ...	70	16 to 25 ft.	...	...
Total for year	448⅞ 0·484	263¼ 0·284	552⅜ 0·596	77 0·083	... ...	... ...	52¼ 0·056	4½ 0·0048	... ...	207¼ 0·223	927			

TABLE E.—II. ANSTRUTHER DISTRICT—*continued.* ST. MONANCE.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																		Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (26)	1065¾	1·8	415	0·701	590	0·996	51	0·0861	...	...	...	...	...	...	...	...	3	0·005	2	0·0033	592	24 to 56 ft.	...	...
Feb. (22)	1720¼	4·145	156	0·376	394	0·949	27	0·065	...	...	...	...	...	..	...	...	...	...	...	...	415	24 to 56 ft.	...	...
Mar. (27)	1578½	2·907	195	0·359	141	0·259	7	0·013	...	...	...	...	...	...	...	...	2	0·0037	5½	0·01	543	24 to 56 ft.	20	44 to 56 ft.
Apr. (25)	28	0·085	82	0·248	502	1·521	52	0·158	...	...	...	...	...	...	...	...	...	...	...	...	330	24 to 45 ft.	38	45 to 56 ft.
May (27)	...	...	66	0·176	517	1·382	98	0·262	...	...	...	...	..	...	...	...	...	...	...	...	374	24 to 30 ft.	46	45 to 56 ft.
June (21)	...	...	36	0·17	218	1·028	66	0·311	...	...	...	...	...	...	...	...	...	...	...	...	212	24 to 30 ft.	47	45 to 56 ft.
July (23)	7⅞	0·068	28	0·241	73	0·629	51	0·439	...	...	...	...	...	...	...	...	...	...	...	...	116	24 to 28 ft.	...	...
Aug. (23)	...	...	39	0·361	58	0·537	23	0·213	...	...	...	...	...	...	...	...	...	...	...	...	108	24 to 28 ft.	...	...
Sept. (16)	...	...	39	0·361	99	0·917	15	0·139	...	...	...	...	...	...	...	...	...	...	...	...	108	24 to 30 ft.	...	...
Oct. (23)	...	...	108	0·37	286	0·98	46	0·157	...	...	...	...	...	...	...	...	...	...	...	...	292	24 to 30 ft.	...	...
Nov. (24)	...	...	322	0·98	288	0·873	53	0·16	...	...	...	...	...	...	..	...	4	0·0121	4	0·0121	330	24 to 54 ft.	...	...
Dec. (23)	364	0·91	656	1·64	405	1·012	62	0·155	...	...	...	...	...	...	...	...	18	0·045	13	0·0325	400	24 to 56 ft.	...	...
Total for year	4764⅜	1·247	2142	0·56	3571	0·935	551	0·144	...	...	...	...	...	...	...	...	27	0·007	24½	0·0064	3820		151	

TABLE E.—II. ANSTRUTHER DISTRICT—*continued.* PITTENWEEM.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (19)	98	0·671	37	0·253	208	1·425	7	0·048	...	...	...	...	...	...	...	...	...	...	...	...	146	2 ft.	215	50 ft.
Feb. (14)	321⅛	4·034	23	0·217	151	1·424	3	0·028	...	...	...	...	...	...	...	...	...	...	...	...	106	25 ft.	177	50 ft.
Mar. (15)	189	1·643	48	0 418	70	0·609	3	0·026	...	...	...	...	...	...	...	...	...	...	...	...	115	25 ft.	135	50 ft.
Apr. (24)	...	...	85	0·409	237	1·14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	208	25 ft.	2	50 ft.
May (27)	...	...	45	0·196	286	1·25	6	0·026	...	...	...	...	...	...	...	...	...	...	...	...	229	25 ft.	11	50 ft.
June (23)	...	...	24	0·126	200	1·052	16	0·084	...	...	...	...	...	...	...	...	...	...	...	...	190	25 ft.	...	...
July (20)	...	...	26	0·154	154	0·911	14	0·083	...	...	...	...	...	...	...	...	...	...	...	...	169	25 ft.	...	...
Aug. (20)	...	...	18	0·113	96	0·604	13	0·081	...	...	...	...	...	...	...	...	...	...	...	...	159	25 ft.	...	...
Sept. (18)	...	...	14	0·155	68	0·755	4	0·044	...	...	...	...	...	...	...	...	...	...	...	...	90	25 ft.	...	...
Oct. (17)	...	...	16	0·166	86	0·896	7	0·073	...	...	...	...	...	...	...	...	...	...	...	...	96	25 ft.	...	...
Nov. (18)	...	...	35	0·259	115	0·852	12	0·088	...	...	...	...	...	...	...	...	...	...	...	...	135	25 ft.	50	48 to 50 ft.
Dec. (14)	...	...	49	0·445	139	1·263	11	0·1	...	...	...	...	...	...	...	...	...	...	...	..	110	25 ft.	56	48 to 50 ft.
Total for year	608⅛	0·347	420	0·239	1810	1·032	96	0·055	...	...	...	...	...	...	...	...	...	...	...	...	1753		646	

TABLE E.—II. ANSTRUTHER DISTRICT—*continued.* ANSTRUTHER.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																		Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Crans.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (26)	5803	13·011	3¼	0·007	71	0·16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	446	25 to 58 ft.	632	46 to 88 ft.
Feb. (21)	3677½	30·773	356	0·298	48½	0·04	...	...	...	...	...	...	17	0·014	...	...	...	...	...	...	1195	18 to 58 ft.	74	54 to 88 ft.
Mar. (24)	2187½	23·88	441	0·481	10	0·01	...	...	...	...	...	...	8	0·0089	...	...	...	...	...	...	916	18 to 58 ft.	103	56 to 88 ft.
Apr. (11)	2184	26·634	66	0·805	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	82	40 to 50 ft.	163	50 to 58 ft.
May (13)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	268	50 to 88 ft.
June (12)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	134	46 to 88 ft.
July (14)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45	40 to 56 ft.
Aug. (18)	70	1·555	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45	22 to 40 ft.	90	45 to 88 ft.
Sept. (4)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7	40 to 88 ft.
Oct. (20)	...	...	3½	0·0875	47½	1·187	...	...	...	...	...	...	...	...	...	...	...	...	...	...	40	18 to 24 ft.	4	45 to 55 ft.
Nov. (12)	...	...	5¼	0·229	23	0·958	...	...	...	...	...	...	...	...	...	...	...	...	...	...	24	19 to 25 ft.	30	52 to 88 ft.
Dec. (17)	248½	31·062	59	0·737	16	0·2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	80	25 to 57 ft.	132	50 to 88 ft.
Total for year	6695½	23·677	934	0·33	216	0·076	...	...	...	...	...	...	25	0·0088	...	...	...	...	...	...	2828		1682	

TABLE E.—II. ANSTRUTHER DISTRICT—*continued.* CRAIL.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (16)	...	...	103½	0·605	93½	0·546	...	...	...	...	...	...	...	...	5	0·029	...	...	...	...	171	17 to 26 ft.	...	...
Feb. (15)	...	...	71½	0·554	106	0·821	...	...	...	...	...	...	...	...	7	0·054	...	...	...	...	129	17 to 26 ft.	...	...
Mar. (25)	...	...	83½	0·18	3	0·0065	...	...	...	...	...	...	...	...	2	0·0043	...	...	...	...	463	16 to 26 ft.	...	...
Apr. (25)	...	...	114	0·213	...	...	...	...	...	...	...	...	...	...	7½	0·014	Crab	boats.			534	16 to 26 ft.	...	...
May (26)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Crab	boats.			550	16 to 26 ft.	...	...
June (23)	...	...	68	0·166	37	0·09	...	...	...	...	...	...	...	...	8	0·019	Crab	boats.			410	16 to 26 ft.	...	...
July (24)	...	...	85	0·271	134½	0·43	...	...	Crab fishing and line fishing boats.								...	...	...	...	313	16 to 26 ft.	...	...
Aug. (27)	...	...	55½	0·295	144½	0·769	...	...	...	...	...	...	...	...	28	0·149	...	...	...	...	188	16 to 26 ft.	1	52 ft.
Sept. (19)	...	...	50½	0·4	62	0·491	...	...	...	...	...	...	...	...	28	0·222	...	...	...	...	126	18 ft.	...	...
Oct. (24)	...	...	78½	0·358	23½	0·107	...	..	...	...	...	...	...	...	7½	0·034	...	...	...	...	219	16 to 26 ft.	...	...
Nov. (16)	...	...	111	0·735	20	0·132	...	...	...	...	...	...	...	...	9½	0·062	...	...	...	...	151	16 to 26 ft.	...	...
Dec. (21)	...	...	127	1·00	117	0·921	..	...	...	...	...	...	...	...	4½	0·035	...	...	...	...	127	16 to 26 ft.	...	...
Total for year	...	...	945	0·279	741	0·219	...	...	...	...	...	...	...	...	107	0·031	...	...	...	...	3381		1	

TABLE E.—II. ANSTRUTHER DISTRICT—*continued.* ST. ANDREWS.

Months and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (11)	...	...	11	0·323	...	...	...	...	...	...	...	...	46	1·353	...	...	...	...	...	...	34	25 to 42 ft.	219	30 to 43 ft.
Feb. (19)	...	...	6	0·044	7	0·052	...	...	...	...	...	...	351	2·619	...	...	...	...	...	...	134	18 to 42 ft.	187	30 to 43 ft.
Mar. (26)	...	...	...	...	...	...	...	...	...	...	...	...	480	1·853	5	0·019	...	...	...	...	259	20 to 42 ft.	114	30 to 43 ft.
Apr. (23)	...	...	...	...	8	0·117	...	...	...	...	...	...	168	2·47	10	0·147	...	...	...	...	68	20 to 30 ft.	185	42 to 43 ft.
May (26)	...	...	...	...	...	...	...	...	...	...	...	...	115	1·402	57	0·695	...	...	...	...	82	20 to 30 ft.	224	30 to 43 ft.
June (23)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	63	0·692	...	...	...	...	91	20 to 30 ft.	276	30 to 43 ft.
July (16)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20	0·645	...	...	...	...	31	20 to 30 ft.	104	30 to 43 ft.
Aug. (23)	...	...	...	...	26	0·44	...	...	...	...	...	...	...	...	27	0·45	...	...	...	...	59	20 to 30 ft.	113	30 to 43 ft.
Sept. (21)	...	...	...	...	131	1·617	...	...	...	...	...	...	...	...	35	0·432	...	...	...	...	81	20 to 42 ft.	111	30 to 56 ft.
Oct. (24)	...	...	...	...	593	4·118	...	...	...	...	...	...	9	0·0625	35	0·243	...	...	...	...	144	20 to 42 ft.	145	30 to 54 ft.
Nov. (16)	...	...	71	0·703	138	1·366	...	...	...	...	...	...	26½	0·262	21	0·208	...	...	...	...	101	20 to 42 ft.	101	30 to 42 ft.
Dec. (19)	...	...	136	1·6	134	1·576	...	...	...	...	...	...	1	0·11	1	0·011	...	...	...	...	85	20 to 42 ft.	152	30 to 42 ft.
Total for year	...	...	224	0·191	1037	0·887	...	...	...	...	...	...	1196½	1·023	274	0·234	...	...	...	...	1169		1931	

TABLE E.—III. MONTROSE DISTRICT. Broughty Ferry.

Months and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.										Number of Trips and Size of Boats Fishing.			
	Herring.	Cod.	Haddock.	Whiting.	Lemon Soles.	Turbot. and Brill.	Plaice and Flounders.	Dabs.	Skate.	Other White Fish.	Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (13)	... ...	3¾ 0·087	17 0·395	1 0·023	... ...	... ...	70½ 1·639	½ 0·0116	... ...	4 0·094	43	18 to 20 ft.	146	30 to 50 ft.
Feb. (17)	... ...	... ...	... ...	... ...	... ...	... ...	399 1·765	... ...	... ...	... ...	226	18 to 30 ft.	112	35 to 50 ft.
Mar. (14)	... ...	... ...	... ...	... ...	... ...	... ...	351 1·928	... ...	... ...	... ...	182	18 to 20 ft.	112	30 to 60 ft.
Apr. (21)	... ...	1½ 0·0097	31 0·201	5½ 0·0357	... ...	... ...	211½ 1·373	54½ 0·354	... ...	13¼ 0·086	154	18 to 30 ft.	209	30 to 50 ft.
May (18)	... ...	½ 0·0082	38½ 0·631	7¼ 0·119	... ...	... ...	33 0·541	39½ 0·647	... ...	18½ 0·303	61	18 to 26 ft.	180	18 to 50 ft.
June (18)	... ...	1 0·0208	36½ 0·75	4 0·083	... ...	... ...	36 0·75	26 0·541	... ...	16¾ 0·349	48	18 to 20 ft.	130	20 to 55 ft.
July														
Aug.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	...	... ...	2	42 to 50 ft.
Sept. (21)	... ...	8 0·035	43½ 0·191	7¾ 0·034	... ...	... ...	25 0·11	30½ 0·134	... ...	446 1·964	227	18 to 26 ft.	79	40 to 50 ft.
Oct. (15)	... ...	... ...	67½ 0·759	... ...	... ...	... ...	22 0·247	21½ 0·242	... ...	90 1·011	89	18 to 36 ft.	85	36 to 50 ft.
Nov. (16)	... ...	16¾ 0·107	68½ 0·436	1½ 0·0096	¼ 0·0016	... ...	33 0·21	19 0·121	... ...	114 0·726	157	18 to 20 ft.	64	30 to 50 ft.
Dec. (17)	... ...	11½ 0·116	44 0·444	½ 0·005	... ...	... ...	19¾ 0·199	12 0·121	... ...	90½ 0·914	99	18 to 30 ft.	93	30 to 50 ft.
Total for year	... ...	43 0·0334	346½ 0·269	27½ 0·021	¼ 0·0002	... ...	1200¾ 0·935	203½ 0·158	... ...	793 0·616	1286		1212	

TABLE E.—III. MONTROSE DISTRICT—*continued.* ARBROATH.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.										Number of Trips and Size of Boats Fishing.			
	Herring.	Cod.	Haddock.	Whiting.	Lemon Soles.	Turbot and Brill.	Plaice and Flounders.	Dabs.	Skate.	Other White Fish.	Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (13)	... ...	6 0·079	32 0·424	... ...	... ...	... ...	... ...	... ...	... ...	50 0·658	76	18 to 30 ft.	432	30 to 45 ft.
Feb. (15)	... ...	2½ 0·0357	14 0·2	... ...	... ...	... ...	... ...	... ...	... ...	77 1·1	70	18 to 30 ft.	474	30 to 45 ft.
Mar. (15)	... ...	... ...	3½ 0·071	... ...	... ...	... ...	1 0·0204	1 0·0204	... ...	44 0·898	49	18 to 30 ft.	408	30 to 45 ft.
Apr. (21)	... ...	... ...	45½ 0·5	... ...	... ...	... ...	... ...	... ...	... ...	46 0·505	91	18 to 30 ft.	427	30 to 50 ft.
May (22)	... ...	1 0·009	87 0·777	... ...	... ...	... ...	... ...	... ...	... ...	18 0·16	112	18 to 40 ft.	383	30 to 50 ft.
June (23)	... ...	... ...	22 0·259	... ...	... ...	... ...	... ...	... ...	... ...	67½ 0·794	85	18 to 30 ft.	307	30 to 50 ft.
July (25)	... ...	½ 0·0075	30½ 0·455	... ...	... ...	... ...	... ...	... ...	... ...	33½ 0·5	67	18 to 30 ft.	154	30 to 50 ft.
Aug. (24)	... ...	... ...	27 0·482	... ...	... ...	... ...	... ...	... ...	... ...	22½ 0·402	56	18 to 30 ft.	143	30 to 50 ft.
Sept. (20)	... ...	... ...	35½ 0·386	... ...	... ...	... ...	... ...	16½ 0·179	... ...	57 0·619	92	18 to 30 ft.	401	30 to 50 ft.
Oct. (25)	... ...	... ...	67½ 0·577	... ...	... ...	... ...	... ...	26 0·222	... ...	84½ 0·722	117	18 to 30 ft.	633	30 to 50 ft.
Nov. (19)	... ...	25½ 0·198	62 0·48	... ...	... ...	... ...	... ...	10½ 0·081	... ...	85 0·651	129	18 to 30 ft.	498	30 to 45 ft.
Dec. (19)	2½ 0·016	45 0·294	115 0·751	... ...	... ...	... ...	... ...	... ...	... ...	133 0·869	153	18 to 45 ft.	447	30 to 45 ft.
Total for year	2½ 0·0023	80½ 0·073	541½ 0·493	... ...	... ...	... ...	1 0·0009	54 0·049	... ...	718 0·654	1097		4707	

TABLE E.—III. MONTROSE DISTRICT—*continued.* AUCHMITHIE.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.										Number of Trips and Size of Boats Fishing.			
	Herring.	Cod.	Haddock.	Whiting.	Lemon Soles.	Turbot. and Brill.	Plaice and Flounders.	Dabs.	Skate.	Other White Fish.	Within the Territorial Waters.		Beyond the Territorial Waters.	
1893	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan (6)	... ...	7 0·118	46 0·779	2½ 0·042	... ...	... ...	1½ 0·025	... ...	½ 0·0085	49 0·83	59	18 to 20 ft.	129	18 to 28 ft.
Feb. (6)	... ...	7 0·175	68 1·7	4 0·1	... ...	... ...	3¼ 0·0875	... ...	1 0·025	30 0·75	40	18 to 28 ft.	116	18 to 28 ft.
Mar. (9)	... ...	9 0·082	72⅓ 0·665	4½ 0·041	... ...	... ...	4 0·037	... ...	1 0·0091	93 0·853	109	18 ft.	166	18 ft.
Apr. (8)	... ...	4½ 0·109	42½ 1·036	2¾ 0·067	... ...	... ...	1¼ 0·0305	... ...	½ 0·012	30 0·731	41	16 to 18 ft.	192	18 to 20 ft.
May (7)	... ...	2 0·077	22⅓ 0·865	3½ 0·134	... ...	... ...	1¼ 0·048	... ...	¼ 0·0096	16½ 0·634	26	16 to 20 ft.	171	18 to 20 ft.
June (5)	... ...	1½ 0·136	13⅓ 1·227	1¼ 0·114	... ...	... ...	½ 0·045	... ...	... ...	5 0·454	11	16 to 18 ft.	166	18 to 28 ft.
July (5)	... ...	2 0·222	9½ 1·055	1 0·111	... ...	... ...	½ 0·055	... ...	¼ 0·027	3½ 0·388	9	16 to 20 ft.	38	16 to 20 ft.
Aug. (9)	... ...	1¼ 0·083	19 1·266	2¼ 0·15	... ...	... ...	1 0·066	... ...	¼ 0·016	7¼ 0·483	15	16 ft.	36	18 to 20 ft.
Sept. (6)	... ...	2 0·055	14 0·388	2½ 0·069	... ...	... ...	½ 0·0138	... ...	... ...	25½ 0·708	36	16 to 20 ft.	88	16 to 20 ft.
Oct. (8)	... ...	1¾ 0·06	29½ 1·017	5½ 0·19	... ...	... ...	1½ 0·052	... ...	... ...	14½ 0·5	29	16 to 20 ft.	176	18 to 20 ft.
Nov. (9)	... ...	1¾ 0·103	19 1·118	1¾ 0·103	... ...	... ...	½ 0·029	... ...	... ...	6½ 0·382	17	16 ft.	184	18 to 20 ft.
Dec. (6)	... ...	3½ 0·14	24½ 0·98	4 0·16	... ...	... ...	2¼ 0·09	¼ 0·01	½ 0·02	11½ 0·46	25	16 to 20 ft.	168	18 to 20 ft.
Total for year	... ...	43¼ 0·103	380½ 0·912	35½ 0·851	... ...	... ...	18 0·043	¼ 0·0006	4¼ 0·01	292¼ 0·7	417		1630	

TABLE E.—III. MONTROSE DISTRICT—*continued.* MONTROSE.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.										Number of Trips and Size of Boats Fishing.			
	Herring.	Cod.	Haddock.	Whiting.	Lemon Soles.	Turbot and Brill.	Plaice and Flounders.	Dabs.	Skate.	Other White Fish.	Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (17)	... ...	34 0·309	103 0·936	... ...	... ...	... ...	... ...	6½ 0·059	... ...	29 0·263	110	18 to 25 ft.	493	30 to 54 ft.
Feb. (3)	... ...	1½ 0·125	17 1·416	... ...	... ...	... ...	... ...	... ...	... ...	1½ 0·125	12	18 ft.	866	18 to 54 ft.
Mar. (21)	... ...	10 0·0645	46 0·296	... ...	... ...	... ...	36 0·232	10½ 0·068	... ...	33 0·213	155	18 to 25 ft.	539	25 to 54 ft.
Apr. (22)	... ...	... ...	165¼ 0·96	... ...	... ...	... ...	14½ 0·084	... ...	... ...	32½ 0·189	172	18 to 30 ft.	285	30 to 50 ft.
May (21)	... ...	½ 0·0057	79 0·908	½ 0·0057	... ...	...	... ...	... ...	... ...	17¼ 0·198	87	18 to 20 ft.	312	30 to 50 ft.
June (23)	... ...	... ...	30 0·545	... ...	.. ...	... ...	... ..	... ...	... ...	... ...	55	16 to 22 ft.	278	30 to 50 ft.
July (18)	... ...	... ...	67⅞ 1·077	12¾ 0·202	... ...	... ...	... ...	... ...	... ...	10⅜ 0·165	63	18 to 22 ft.	224	30 to 50 ft.
Aug. (18)	... ...	... ...	39¾ 0·736	... ...	... ...	... ...	... ...	... ...	... ...	11¾ 0·217	54	18 to 22 ft.	228	30 to 50 ft.
Sept. (25)	... ...	... ...	68 0·496	5½ 0·04	... ...	... ...	13½ 0·098	4 0·029	... ...	1½ 0·11	137	18 to 25 ft.	269	25 to 50 ft.
Oct. (19)	... ...	... ...	46 0·676	5¾ 0·084	... ...	... ...	8¼ 0·121	... ...	... ...	15½ 0·228	68	18 to 25 ft.	584	30 to 50 ft.
Nov. (17)	... ...	... ...	13 0·419	½ 0·016	... ...	... ...	... ...	... ...	... ...	10½ 0·339	31	18 to 25 ft.	529	25 to 50 ft.
Dec. (16)	... ...	9½ 0·237	16 0·4	... ...	... ...	... ...	1½ 0·037	... ...	... ...	¼ 0·006	40	20 to 25 ft.	679	25 to 50 ft.
Total for year	... ...	55½ 0·564	690⅞ 0·702	25 0·254	... ...	... ...	73¾ 0·075	21 0·021	... ...	163⅛ 0·165	984			

TABLE E.—III. MONTROSE DISTRICT—*continued.* JOHNSHAVEN.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.												Number of Trips and Size of Boats Fishing.			
	Herring.	Cod.	Haddock.	Whiting.	Lemon Soles.	Turbot and Brill.	Plaice and Flounders.	Dabs.	Skate.	Other White Fish.	Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*Cwts. Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (15)	... ...	33½ 0·729	38½ 0·837	... ...	... ...	... ...	... ...	... ...	... ...	41½ 0·902	46	18 to 25 ft.	216	25 to 35 ft.
Feb. (15)	... ...	40 0·851	43 0·915	... ...	... ...	... ...	... ...	... ...	... ...	22 0·468	47	18 to 22 ft.	261	25 to 35 ft.
Mar. (20)	... ...	28½ 0·331	5 0·058	... ...	... ...	... ...	... ...	... ...	... ...	84 0·977	86	22 to 25 ft.	218	25 to 35 ft.
Apr. (5)	... ...	... ...	15½ 0·969	... ...	... ...	... ...	... ...	... ...	... ...	... ...	16	18 to 22 ft.	110	30 to 45 ft.
May (14)	... ...	... ...	42 1·024	2 0·0488	... ...	... ...	... ...	... ...	... ...	... ...	41	18 to 22 ft.	85	29 to 50 ft.
June (6)	... ...	... ...	12 0·75	... ...	... ...	... ...	... ...	... ...	... ...	6 0·375	16	18 to 22 ft.	673	25 to 50 ft.
July	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	...	...	...	...
Aug. (9)	... ...	... ...	11 0·785	... ...	... ...	... ...	... ...	... ...	... ...	3 0·214	14	18 ft.	3	35 ft.
Sept. (17)	... ...	... ...	89½ 1·336	24½ 0·365	... ...	... ...	... ...	... ...	... ...	18½ 0·276	67	18 to 22 ft.	37	22 to 35 ft.
Oct. (17)	... ...	2½ 0·035	108 1·521	... ...	... ...	... ...	... ...	... ...	... ...	17½ 0·246	71	18 to 22 ft.	171	25 to 35 ft.
Nov. (17)	... ...	24½ 0·454	62 1·148	... ...	... ...	... ...	... ...	... ...	... ...	67 1·241	54	18 to 22 ft.	167	25 to 35 ft.
Dec. (14)	... ...	63 1·033	64½ 1·057	1 0·0164	... ...	... ...	... ...	... ...	... ...	107 1·754	61	18 to 28 ft.	215	25 to 35 ft.
Total for year	... ...	**192 0·369**	**491 0·946**	**27½ 0·053**	... ...	... ...	... ...	... ...	... ...	**366½ 0·706**	**519**		**2156**	

TABLE E.—III. MONTROSE DISTRICT—*continued.* GOURDON.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																		Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (13)	20	0·476	10	0·238	50	1·194	...	...	...	...	...	...	...	...	...	...	...	...	46	1·095	42	30 to 35 ft.	637	30 to 39 ft.
Feb. (11)	...	...	7	0·226	55	1·774	...	...	...	...	...	...	...	...	...	...	...	...	28	0·903	31	30 to 34 ft.	631	30 to 40 ft.
Mar. (16)	...	...	...	...	120	1·791	...	...	...	...	...	...	...	...	...	...	...	...	79	1·179	67	30 to 35 ft.	773	30 to 40 ft.
Apr. (17)	...	...	36	0·5	120	1·666	20	0·277	...	...	...	...	...	...	...	...	...	...	62	0·861	72	21 to 30 ft.	753	30 to 40 ft.
May (18)	...	...	23	0·23	132	1·32	31	0·31	...	...	...	...	...	...	...	..	...	...	90	0·9	100	30 to 40 ft.	732	30 to 40 ft.
June (10)	...	...	14	0·56	46	1·84	...	...	...	...	...	...	...	...	...	...	...	...	22	0·88	25	27 to 35 ft.	480	27 to 40 ft.
July (11)	...	...	...	...	26	0·928	16	0·571	...	...	...	...	...	...	...	...	...	...	10	0·357	28	32 to 34 ft.	173	30 to 40 ft.
Aug. (6)	...	...	...	...	20	1·538	...	...	...	...	...	...	...	...	...	...	...	...	14	1·077	13	30 to 35 ft.	27	30 to 37 ft.
Sept. (21)	...	...	...	...	202	1·566	2½	0·019	1	0·0077	...	...	1	0·0077	...	...	...	...	162	1·256	129	25 to 39 ft.	443	28 to 39 ft.
Oct. (22)	...	...	...	...	101	1·464	41	0·594	...	...	...	...	...	...	...	...	...	...	64	0·927	69	22 to 28 ft.	680	30 to 40 ft.
Nov. (17)	...	...	31	0·66	54	1·149	...	...	...	...	...	...	...	...	...	...	...	...	37	0·787	47	27 to 30 ft.	615	32 to 40 ft.
Dec. (15)	90	1·364	134	2·03	20	0·303	...	...	...	...	...	...	...	...	...	...	...	...	28	0·424	66	29 to 35 ft.	652	32 to 40 ft.
Total for year	110	0·159	255	0·37	946	1·373	110½	0·16	1	0·0014	...	...	1	0·0014	...	...	...	...	642	0·931	689		6596	

TABLE.—IV. STONEHAVEN DISTRICT. Shieldhill to Skateraw.

Month and Number of Days Fishing.	Quantity of Net and Line Fish caught within the Territorial Waters.																				Number of Trips and Size of Boats Fishing.			
	Herring.		Cod.		Haddock.		Whiting.		Lemon Soles.		Turbot and Brill.		Plaice and Flounders.		Dabs.		Skate.		Other White Fish.		Within the Territorial Waters.		Beyond the Territorial Waters.	
1893.	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*Cwts.*	*Aver.*	*No.*	*Size.*	*No.*	*Size.*
Jan. (23)	717	0·93	261	0·339	1331	1·728	5	0·0065	...	...	...	...	3	0·0039	...	...	...	...	43	0·056	770	18 to 38 ft.	324	28 to 38 ft.
Feb. (20)	...	...	202	0·216	2600	2·783	17	0·018	...	...	...	...	10	0·0107	...	...	...	...	25	0·0267	934	18 to 38 ft.	302	34 to 38 ft.
Mar. (25)	...	...	305	0·325	1509	1·61	...	...	...	...	...	...	15	0·016	...	...	...	...	14	0·015	937	18 to 38 ft.	613	30 to 38 ft.
Apr. (25)	...	...	374	0·581	304	0·472	2	0·0031	...	.	...	...	6	0·0093	...	...	...	...	5	0·0077	643	18 to 26 ft.	371	18 to 55 ft.
May (27)	...	...	241	0·388	404	0·651	50	0·0806	...	...	...	...	3	0·0048	...	...	...	...	9	0·0145	620	18 to 26 ft.	398	18 to 58 ft.
June (24)	...	...	102	0·232	339	0·772	169	0·385	...	...	...	...	4	0·0091	...	...	...	...	80	0·0182	439	18 to 24 ft.	313	18 to 55 ft.
July (24)	...	...	9	0·0221	245	0·603	198	0·488	...	...	.	...	5	0·012	...	...	3	0·0074	264	0·65	406	18 to 24 ft.	802	40 to 58 ft.
Aug. (23)	...	...	50	0·143	126	0·361	78	0·223	...	...	...	...	10	0·0286	...	..	...	...	381	1·091	349	18 to 22 ft.	574	18 to 58 ft.
Sept. (23)	...	...	198	0·346	1046	1·829	84	0·146	...	...	...	...	81	0·141	...	...	...	...	18	0·031	572	18 to 22 ft.	306	18 to 38 ft.
Oct. (26)	...	...	394	0·464	1680	1·981	208	0·245	1	0·0012	...	...	65	0·076	...	...	...	...	43	0·005	848	18 to 24 ft.	590	26 to 38 ft.
Nov. (22)	144	0·224	802	1·249	837	1·304	66	0·103	...	...	...	...	26	0·0405	...	...	5	0·0077	56	0·087	642	18 to 38 ft.	555	32 to 38 ft.
Dec. (25)	480	0·635	972	1·285	617	0·816	6	0·0079	...	...	...	...	...	...	...	...	7	0·0092	63	0·083	756	18 to 38 ft.	374	30 to 38 ft.
Total for year	1341	0·169	3910	0·494	11038	1·394	883		1	0·00012	...	...	228	0·111	...	...	15	0·0019	1001	0·126	7916		5522	

TABLE F.—Showing the Quantities of Fish (in Cwts.) captured by Line Fishermen in the Territorial Waters of certain districts, with the Average per 'shot' in 1891, 1892 and 1893.

Note.—The Decimal figures in the second columns give the average cwts. per 'shot.'

DISTRICT.	Cod.		Haddock.		Whiting.		Lemon Soles, Flounders and Dabs.		Skate and Turbot.		Other White Fish.		Total Fish.		Total Trips.
1891.															
Leith,	12,474½	1·63	5,017½	0·65	1,564¼	0·20	1,805	0·23	602	0·07	944	0·12	22,407	2·943	7,613
Anstruther,	10,129⅔	0·74	9,845	0·72	1,620¾	0·11	2,722	0·19	2½	0·00	430	0·03	24,749⅔	1·810	13,670
Montrose,	2,206¼	0·24	12,321½	1·36	1,370½	0·15	2,535	0·28	24⅝	0·00	4,119¾	0·46	22,577½	2·521	8,954
Stonehaven,	3,990	0·51	14,807	1·92	3,537	0·54	156½	0·02	5	0·00	239	0·03	22,734½	2·956	7,691
Total,	28,800¼	0·75	41,991	1·13	8,092½	0·21	7,218½	0·19	634¼	0·01	5,732¾	0·15	92,469	2·438	37,928
1892.															
Leith,	9,485½	1·35	7,826½	1·12	716	0·10	1,965	0·28	485½	0·06	484	0·06	20,962½	3·001	6,983
Anstruther,	7,303¼	0·53	9,822¼	0·71	776½	0·05	2,077⅜	0·15	36	0·002	171½	0·01	20,187	1·47	13,713
Montrose,	660	0·12	3,897¼	0·71	235¼	0·04	1,553¾	0·28	25¾	0·004	2,072¾	0·38	8,444¾	1·55	5,416
Stonehaven,	4,524	0·70	7,689	1·19	1,012	0·15	137	0·02	38	0·005	426	0·06	13,826	2·10	6,431
Total,	21,972¾	0·67	29,235¼	0·89	2,739½	0·08	5,733½	0·17	585¼	0·01	3,154	0·09	63,420¼	1·94	32,543
1893.															
Leith,	7,436	1·306	4,436⅛	0·779	371	0·065	1,982½	0·348	575½	0·101	316½	0·055	15,118	2·656	5,691
Anstruther,	5,423¼	0·338	10,097⅜	0·629	724	0·045	2,408¼	0·15	27	0·0016	232¼	0·014	18,911	1·179	16,032
Montrose,	669¼	0·134	3,396	0·68	226	0·045	1,574½	0·315	4¼	0·0008	2,974⅞	0·596	8,844	1·771	4,992
Stonehaven,	3,910	0·493	11,038	1·394	883	0·112	229	0·029	15	0·002	1,001	0·126	17,076	2·157	7,916
Total,	17,438½	0·504	28,968¼	0·836	2,204	0·063	6,194¼	0·178	621¾	0·017	4,524⅝	0·131	59,949	1·703	34,631

TABLE G.—Showing the Quantities Monthly of Large and Small Fish Landed in Aberdeen District by Beam Trawlers and Line Fishermen in 1893.

Month.	District.	Cod (Large).	Cod (Small).	Haddock (Large).	Whiting (Large).	Haddock and Whiting (Small).	Turbot (Large).	Turbot (Small).	Halibut (Large).	Halibut (Small).	Lemon Sole, Flounder, Plaice, Brill (Large).	Lemon Sole, Flounder, Plaice, Brill (Small).	Other kinds of White Fish Large).	Other kinds of White Fish (Small).
	ABERDEEN.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
Jan.	I. Beam trawl,	1658	1313	14,628	113	228	...	...	...	...	3204	64	...	...
	II. Line,	1230	169	2234	12	332	...	...	...	...	...	5	...	...
Feb.	I. Beam trawl,	2163	1018	21,707	102	422	...	...	...	...	2266	59	...	...
	II. Line,	1796	140	5753	17	293	...	...	...	...	1	1	...	...
Mar.	I. Beam trawl,	2990	445	2114	202	393	...	...	...	...	2261	53	...	...
	II. Line,	2769	206	3443	50	1338	...	...	...	...	13	90	...	...
April	I. Beam trawl,	2738	995	9009	1057	494	...	...	...	...	3323	154	...	...
	II. Line,	8428	1041	2308	325	1247	...	...	...	...	...	8	...	...
May	I. Beam trawl,	2296	1343	7947	259	373	...	...	...	...	5535	210	...	...
	II. Line,	14,736	1182	2947	405	1258	...	...	...	...	...	...	...	...
June	I. Beam trawl,	1835	766	7704	594	377	...	...	...	...	5164	128	...	...
	II. Line,	4264	225	2424	885	886	...	...	...	...	...	...	...	...
July	I. Beam trawl,	1756	1201	10,881	200	203	...	...	...	...	4915	98	...	...
	II. Line,	1899	69	450	1203	772	...	...	...	...	...	20	...	...
Aug.	I. Beam trawl,	2296	1961	18,536	419	467	...	...	...	...	4237	126	...	...
	II. Line,	901	80	164	965	672	...	...	...	...	...	24	...	...

TABLE G.—Showing the Quantities Monthly of Large and Small Fish Landed in Aberdeen District by Beam Trawlers and Line Fishermen in 1893—*continued.*

Month.	District.	Cod (Large).	Cod (Small).	Haddock (Large).	Whiting (Large).	Haddock and Whiting (Small).	Turbot (Large).	Turbot (Small).	Halibut (Large).	Halibut (Small).	Lemon Sole, Flounder, Plaice, Brill (Large).	Lemon Sole, Flounder, Plaice, Brill (Small).	Other kinds of White Fish (Large).	Other kinds of White Fish (Small).
	ABERDEEN—*continued.*	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
Sept.	I. Beam trawl,	2667	1522	16,915	191	790	...	...	...	...	3051	132	...	...
	II. Line,	688	75	313	275	2299	...	...	...	...	...	27	...	...
Oct.	I. Beam trawl,	3428	1912	16,473	274	555	...	...	...	...	4272	123	...	...
	II. Line,	1540	167	443	279	3839	...	...	...	...	...	23	...	...
Nov.	I. Beam trawl,	2623	2016	13,793	278	367	...	...	...	...	4767	93	...	...
	II. Line,	2544	536	510	115	2180	...	...	...	...	...	...	...	...
Dec.	I. Beam trawl,	1556	1111	12,566	148	330	...	...	...	...	5271	116	...	...
	II. Line,	3286	714	801	27	1628	...	...	...	...	...	6	...	...
Tl. for Year.	Beam trawl,	28,006	15,603	152,273	3837	4999	...	...	...	...	48,266	1356	...	...
	Line,	44,081	4554	21,790	4558	16,744	...	...	...	...	14	204	...	...

TABLE H.—Showing the Monthly Amounts in cwts. of Round and Flat Fish landed by Line Fishermen and Beam Trawlers on the East Coast of Scotland during 1893.

Month.	Northern Section (from Aberdeen northwards).				Southern Section (south of Aberdeen).				Whole East Coast.			
	Round Fish.		Flat Fish.		Round Fish.		Flat Fish.		Round Fish.		Flat Fish.	
	Line.	Beam Trawl.	Line.	Beam Trawl.	Line.	Beam Trawl.	Line.	Beam Trawl.	Line.	Beam Trawl.	Line.	Beam Trawl.
January,	914	18,815	631¾	3,380½	25,838	7,222	575	1,015	74,752½	26,037	1,206¾	4,395½
February	60,143	26,992	1,562¼	2,488	31 474	11 647	2,111	2,153	91,617	38,639	3,673¼	4,641
March,	46,260	26,554	4,581½	2,652	21,200	9,886	2,049¼	1,850	67,460	36,440	6,630¾	4,502
April,	62,216	15,889	5,155½	3,865	36,779	12,859	2,078½	2,072	98,995	28,748	7,234	5,937
May,	61,357	13,170	4,178¼	6,071	52,684	8,146	1,782	1,678	114,041	21,316	5,960¼	7,749
June,	22,806	13,485	1,826	5,629	25,943	8,336	982	1,768	48,749	21,821	2,808	7,397
July,	12,940	14,860	1,764	5,304	6,017	8,024	374	1,621	18,957	22,884	2,138	6,925
August,	12,945	24,278	1,488	4,889	3,898	10,254	423	1,589	16,843	34,532	1,911	6,478
September,	23,889	22,990	432	3,528	10,727	8,025	737	1,688	34,616	31,015	1,169	5,216
October,	35,704	23,489	681	4,560	20,889	8,815	933	1,690	56,593	32,304	1,614	6,250
November,	34,264	20,070	348½	4,977	22,047	5,849	736	905	56,311	25,919	1,084½	5,882
December,	33,333	16,570	232	5,450	25,888	7,659	1,241½	1,335	59,221	24,229	1,473½	6,785
Totals,	454,771½	237,162	22,880¾	52,793½	283,384	106,722	14,022¼	19,364	738,155½	343,884	36,903	72,157½

II.—REMARKS ON TRAWLING. By Professor M'Intosh, M.D., LL.D., F.R.S., F.R.S.E.

FIRST SERIES.*

1. General Remarks.

Fully ten years having elapsed since the Report on Trawling on the eastern shores was presented to the Trawling Commission (composed of the late Earl of Dalhousie, chairman; Right Hon. Edward Marjoribanks, M.P., now Lord Tweedmouth; Prof. Huxley; Mr W. S. Caine, M.P.; and Mr, now Sir, T. F. Brady), it appears to be desirable to review the statements contained therein in the light of the information which the impetus given by the Commission has produced. Moreover, this examination of results is all the more necessary, since last year another important body—viz., the Select Committee of the House of Commons on Fisheries, presided over by Mr Marjoribanks, M.P.—issued a new blue-book containing the finding of the Committee, and a mass of evidence.

In criticising this Report on Trawling, it is necessary to bear in mind that certain definite instructions were given by the Commission in regard to the hauls of the trawl. These fall under Section 6, and are as follow:—'The results of each haul of the trawl, so far as regards food-fishes, 'should be carefully registered, in order that positive data may be obtained.

'(*a*) As to the proportional quantity of immature fishes taken at 'various seasons.

'(*b*) As to the destruction of the spawn of food-fishes.

'(*c*) As to the proportion of live and dead fishes.'

It is important to remember, also, that the choice of ground lay with the trawler in almost every case, and that the most productive ground, so far as could be ascertained, would in all probability be selected.

In the Report of 1884 the fishes were grouped into 'saleable,' 'unsale-'able,' and 'young,' the latter term being synonymous with that now in general use, viz., 'immature'—a term, indeed, which was introduced prominently in this report. These three heads are well understood, and need cause no ambiguity, since even the fishing community are quite able to understand them—a size limit, of course, in every case having been considered. To the Royal Commissioners the fact that a young or immature dab was under 7 inches was not of great utility, but the number of such young forms was of the utmost importance in view of the statements then prevalent. Due care was taken to see personally that every example was authenticated, and if any weight is to be attached to the statement that the 'great defect of the Report † is that no informa-'tion whatever is given as to the limit of size dividing the saleable fish 'from the immature,' there will be little difficulty in remedying it. Besides, it was not the scientific observer who regulated the sizes of the saleable fishes, but fishermen engaged in an industrial pursuit, and who had to bear in mind the demands of the public. Moreover, a fish of a size that was saleable at St Andrews might not be so at Aberdeen, and *vice versa*, though, as a rule, the variation under this head was not great. According to the state of the market, again, fishes—*e.g.*, gurnards—that were saleable at one season were unsaleable at another. As pointed out

* I have to acknowledge, in the preparation of the 'Remarks,' the courtesy of Mr Esslemont, Chairman of the Board; of Dr Fulton; of Mr W. C. Robertson, the secretary; of Mr Couper, Fishery Officer, Aberdeen; of Messrs Joseph Johnston & Sons, Montrose; of Mr Scott, of the General Steam Fishing Company, Granton; and of the owners and captains of the various vessels, who invariably exerted themselves to furnish information. It was especially interesting to find some of the captains of the General Steam Fishing Company's ships, with whom I had worked in 1884, still at their posts.

† Prof. Ray Lankester, *Sea Fisheries*, Chicago Exhibition, 1893, p. 64.

in the Report, 'It is remarkable that so good a fish should be liable to 'variation in this respect, and that it should not always be taken to market, 'even during the height of the herring-season.' Frog-fishes even occasionally found a ready sale in the great central towns of England after the head, skin, and fins were removed; and in the Outer Hebrides dog-fishes formed, and still form, an important item in the crofters' diet-roll, the piles of skins in front of their huts being characteristic.

To take the fishes in the order in which they are mentioned in the Trawling Report, the following sizes formed the lower limit of the saleable fishes:—Skate (including grey, thornback, starry, sandy, &c.), 10–12 in. across the pectorals; herring, 7–8 in., but those obtained were all much larger; codling (young cod), 8–10 in., but no example so small occurred in the series; haddock, 8–9 in., when so small their price is insignificant—about 1s. per box; whiting, 8–9 in.; poor-cod, 7 in.; bib, 6–7 in.; coal-fish, 1 ft.; hake, 1 ft., though seldom seen below 15 in.; ling, 15–20 in.; halibut, 13 in.; sail-fluke, 8 in.; craig-fluke (witch), 7 in.; long rough dab, 7 in.; turbot, 6–7 in.; brill, 7–8 in.; plaice, 7 in.; dab, 7 in.; lemon-dab, 7 in.; sole, 7 in.; flounder, 7 in., rarely sold; grey gurnard, 9 in.; bream, 9–10 in.; cat-fish or wolf-fish, 15 in., though all those obtained were large. By the term 'saleable,' of course, saleable in the food-market is meant, since much smaller examples of every species might be utilised for manure, either as landed or after preparation in a factory.

In regard to the unsaleable round fishes, the remarks of the Commissioners of 1866 were:—'It has never been alleged that ling, cod, and 'conger, in which the line fishermen are so largely interested, or mackerel, 'pilchards, or herrings, upon which the seine and drift-fishermen depend, 'are caught by the trawl in an immature and uneatable condition.' 'Whiting and haddocks of small size, thought marketable, are taken by 'the trawl; but fish of similar dimensions are also captured by the liners, 'against whom, indeed, the charge of taking immature cod has especially 'been brought.'

In the Report of 1884 it was stated that 'a considerable number of 'young cod were present in most of the good hauls, but all were saleable 'fishes. Quite as many immature cod (codling) were caught by the liners 'in the same waters; and off the Bell Rock, perhaps, the proportion is 'even greater.' The same state of matters exists at this moment. On the other hand, the number of very small haddocks caught by the liners, *e.g.*, last year, off the east coast of Scotland, far exceeded anything of the kind captured by trawlers. The one mode of fishing was as destructive to these immature forms as the other. The small fishes swarmed on the ground, and were caught in every haul of the liners just as they were swept into the trawl, but many of the smaller forms escaped from the latter through the meshes while they were held fast by the hooks, and so injured that, although they had been returned to the water, it is doubtful if they would have survived.

The remarks made then (1884) on the capture of very young cod and very young haddocks, therefore, remain suitable for to-day; and the same may be said of those on whiting, ling, hake, gurnards, coal-fishes, pollack, bib, and poor-cod. In the Trawling Report it was stated that large cod and other adult fishes were now seldom caught within the limits of the Bay of St Andrews, and this was in accordance with the evidence then obtainable. The use of anemones as bait, together with the closure of the bay, shows that as many as sixty or eighty good cod are occasionally caught by a single boat, the lines being buoyed and left in the water all night. Some fine congers are also occasionally obtained off the east rocks. Moreover, excellent haddocks are procured in the same area early in the year, and for two years small haddocks have abounded. Large green cod

also occasionally leap out of the water in pursuit of their prey, and are captured on the beach, while a few pollock are got in the salmon-stake nets or on hooks. It would thus appear that further experience leads to a modification of the statement in the Trawling Report. How far the increase in numbers has been due to the closure and the absence of molestation, and how far to the fixed and extensive lines and special bait, are open questions.

The closure of the inshore waters—*e.g.*, St Andrews Bay—must have conduced to the prosperity of the turbot and the brill of that neighbourhood, most of the turbot (ranging from 9–11 inches) which formerly were captured by the trawlers (sailing- and steam-) now being unmolested, and reaching the outer waters when of some size. The salmon stake-nets, however, on the west sands still prove destructive to many turbot from 5¼ inches upwards. These small examples of this valuable fish are only used as bait for crab-pots. It is true the trawlers sweep the outer waters into which the young turbot and brill pass, but the area is wider, and the size of those captured considerably larger.

No fish formed the subject of greater solicitude in the Trawling Report than the plaice, both from its wide distribution and its great abundance, as well as from the supposed view that this was a form specially destroyed by the trawl, which had cleared out of St Andrews Bay, for example, all the full-grown adults, and left only the smaller forms. It is apparent, therefore, that during the past nine years such inshore waters have had sufficient time for recuperation—at least to some extent—if these views can be maintained. The results of the trawling-work of the 'Garland' up to 1892 have already been dealt with in this connection,* so that other observations, and the statistics of fishes captured by the liners in this area, have only to be considered. Without at present going into detail, it is found that comparatively few full-grown plaice are captured in the enclosed waters of St Andrews Bay. Most of the large specimens that have occurred have been either diseased—*e.g.*, blind or emaciated—or injured. An enormous number of immature or half-grown plaice, however, are reared in the area, and are captured by the liners, chiefly with lob-worm, their lines being buoyed and left in the water for such periods as they please, relays of lines being often used. The success with which the local fishermen ply their trade in early spring amongst the plaice is indicated by the fact that a single haul of the lines of a small fishing-boat last February produced a sum of £9, and that a larger 'catch' was procured by the same boat within the week. The closure of the inshore waters, therefore, while it places the trawl-fishermen at a disadvantage, benefits the line-fishermen, and does not deprive the public altogether of the supply of flat-fishes from the enclosed area. It does not, however, produce many large flat-fishes, for as these get older they appear to seek the deeper waters outside the limit, either from a natural habit, or as the result of constant interference by man. This habit, indeed, was noticed in the Report when dealing with the question of instituting the closure within the three-mile limit—thus:—'The flat-fishes, such as turbot, brill, plaice, soles, dabs, and 'thornback (skate) would certainly be left in comparative security in 'certain bays, as at St Andrews, the larger only, perhaps, seeking the 'grounds in the offing.' These larger flat-fishes, many of which are mature (that is, spawning) are captured outside the three-mile limit in great numbers, and thus the supply of ova and young fishes for the inshore waters is affected, for, as previously pointed out, the latter waters depend to a large extent on the former in this respect. Few or no spawning plaice (none within our experience) are ever captured within the bay, though eggs and young in various stages are not uncommon. It is stated, however, that adult ripe plaice were formerly procured by hook

* A Brief Sketch of the Scottish Fisheries, 1882–1892, p. 6.

and line off the rocky shore towards the mouth of the bay between Boarhills and Fife-Ness, on hard ground on which no trawl could work. The adult spawing plaice in greater numbers occur in the offshore waters, and, so far as known, there is no passage of these from the outer to the inner area for the purpose of discharging their eggs—as was formerly believed in regard to many fishes. If it had been for the advantage of the eggs and larval plaice that the adults should only spawn close inshore in the shallow water, there is no reason to doubt that such would have been the arrangement. It is apparent, however, that it is otherwise. Before reaching the shallow water of the bays the scattered ova have advanced towards hatching or have hatched, the majority probably in the latter condition, the open water being perhaps better suited for their safety. The yolk-sac of the larval fish is soon absorbed, the symmetrical post-larval condition is reached, by-and-by transformation occurs, and the little fish takes to the bottom, swarms being found in the muddy rock-pools towards the end of April and beginning of May. The life-history of this species would seem to show that—in dealing artificially with the eggs and larvæ—the most natural method is to place the larval fishes—just before the yolk-sac is absorbed—some distance from shore. They are more or less transparent, and will escape many of the dangers they run in such waters, and, before being carried close inshore, will either be transformed or about to be transformed, and more capable of escaping by their own exertions from their enemies. If the larvæ are placed in the sea close to a rocky beach or stretch of tidal sand or gravel, it is possible that many would be stranded by the tide. Therefore, though the observation that the young plaice (with eyes now on the right side) abound in spring in the shallow rock-pools and elsewhere is perfectly correct, it is no argument for placing the larval fishes in their neighbourhood, when in a truly pelagic condition. In the same way the spawning ling are found far from the inshore waters, their minute eggs being hatched in the open ocean, and the young stages passed long before reaching the margin of low water. The ling has not, indeed, been found in inshore waters till it reaches about 3 inches ($3\frac{1}{2}$) in length, and then in very limited numbers. It is more frequently secured when from 6 to 8 inches in length—at extreme low water at the margins of the rocks. As it gets larger it seeks the offshore, and thus, as in the plaice, there is a double migration—the wafting of the eggs, larval and young fishes shorewards, and the return of the adolescent and the larger forms seawards. A similar life-history appears to be present in many of the food-fishes—*e.g.*, the turbot, brill, and halibut, though in the case of the dab, long rough dab, and some others, there are marked exceptions, as pointed out in the Trawling Report. Thus, 'the large proportion of immature dabs found 15 miles off 'St Abb's Head is interesting, and shows that such are not confined to 'shallow bays like that of St Andrews. Moreover, the occurrence of 'relatively small specimens at this and even greater distances from land 'would raise a doubt as to whether all such young forms have been reared 'on a sandy beach inshore.' * Since the foregoing was written, opportunities, by aid of the 'Garland,' for using the special trawl-like tow-net and the mid-water net near and at the bottom on the grounds 15 to 20 miles south-east of the Island of May, have been afforded, and great numbers of larval, post-larval, and young dabs, long rough dabs, and other forms have been obtained, thus confirming the opinion formerly expressed. Moreover, the trawling work of the 'Garland' on its various stations from the Moray Firth to the Forth bear out the same conclusion. Again, the deeper water is the home of the post-larval frog-fish,

* *Report, Royal Commission on Trawling*, p. 361.

even the pelagic eggs being rather uncommon near shore. The adolescent and adults, on the other hand, are frequent in shallow sandy bays like St Andrews.

It is apparent, from certain remarks in the preceding paragraph, that it is a mistake to say that the trawl alone can capture flat fishes. If the bait be suitable the lines are tolerably effective in regard to plaice, lemon-dabs, dabs, and flounders. Again, halibut-fishing (by hook) is the most productive method off the coasts of Iceland, Faröe, and elsewhere, and even the turbot and the sole are occasionally caught by the liners.

2. Changes in the Trawling-Vessels and their Apparatus.

With the exception of a few small sailing vessels and boats, trawling in Scottish waters is carried on, as it was in 1884, almost exclusively by steam-vessels; but, whereas at the latter period many of the vessels were old tugs or modified paddle-steamers formerly used for other purposes, most of the modern vessels, *e.g.*, sailing from Granton and Aberdeen, are specially built for the purpose. The finest vessels do not cost much more than the serviceable vessels of the General Steam Fishing Company did in 1884, viz., £4500, but very considerable improvements have occurred in the arrangement and equipment. Some of these iron ships are 100 to 120 feet between the perpendiculars, and considerably more on deck, with a depth of 10 to 12 feet. The paddle-ships at Montrose * are 116 feet between the perpendiculars, 21 feet broad, and 10 feet deep; while the fine screw vessel is no less than 120 feet between the perpendiculars, 21 feet broad, and 11 feet 6 inches deep. The three latter have comparatively low bows, like many of the ships from Granton. The newer ships at Granton have also increased in size. Moreover, greatly increased height is given to the bow of the vessels at Aberdeen, so that the foot-hold on the fore-deck must be very uncertain, especially if slippery; but the water is kept out of the ship by such an arrangement. The after-part of the ship, however, is more or less flat, so that the trawls can easily be worked. These vessels range from 140 to 180 tons burthen, with engines from 40 to 65 horse-power.

Instead of having the steam-winch near the forecabin, in the newest ships it is placed on deck close to the engine-room, so that the steadiness of the ship is increased, and the bow kept out of the water. The screw-vessel at Montrose has two winches, one being behind the foremast, the other (smaller) behind the mainmast. The latter is very useful in discharging fishes, and in working the dandy. In general, the Granton ships have the steam-winch in front, with the capstan behind, just before the engine-room, a different arrangement from that at Aberdeen. Moreover, a decided improvement is introduced by the presence of a 'brake' in connection with this apparatus. In 1884 reliance was placed on the old hawser fixed to the trawl-warp in the case of the net being held by a sunken wreck or a rock. Now, the moment the net is fixed, the 'brake' (which is secured to a moderate degree) permits the trawl-warp to run out, and thus save the net from serious rupture or total destruction while the ship is being stopped. In the Granton ships an iron wire rope is used instead of a hawser from a hook on the mainmast, to save rubbing on the rail. This is fixed to the trawl-warp by spun-yarn. The length of the trawl-warp, which is of steel-wire rope, ranges from 200 to 240 fathoms. The warp has six outer and a central strand. The older warps had a Manilla centre, but the newer have wire. A change has also been made in the teeth of the wheels of the winch, for, instead of being transverse, they are now helical or oblique, in such ships as the

* Messrs Joseph Johnston & Sons.

'Belcher.' The warp is run round a capstan in rear, and out by a slit with rollers in the bulwarks of the ship. The large ends of the winch are used, as formerly, for winding the bridles and all ropes and tackle, the latter being still the method of hoisting on board the bag of the trawl. Instead, however, of the snatch-blocks being fixed to the deck, they now are attached to the top of the engine-room. A considerable number of the paddle-ships still use a 9-inch Manilla hawser as trawl-warp, and it is wound round a capstan from wheels beneath the deck. These also have the piece of old hawser (at Montrose of about 13 fathoms) as a guard during trawling, but, as indicated, the best screw-trawlers have the 'brake' on the winch. In one or two of the older trawlers at Granton, the narrowness of the ship has caused the winch to be placed on the fore part longitudinally, not transversely.

In some of the ships at Aberdeen the steering- or wheel-house has a roof, with side-panels and panes, so as to protect the men, and it occupies the same position, viz., in the centre of the vessel. Others have simply a canvas shelter above the wood. In one of the newest vessels at Aberdeen, the steering-house is open, as it is stated the men are apt to sleep in the covered houses, and prefer to be in the open air during their watches, while it is interesting to note that the Granton General Steam-Fishing Company's ships have always had open wooden wheel-houses. Besides a spirit-compass on a stand, a new vessel has an inverted one on a wooden pole, so that two are available in steering. Coals are still carried in the side-bunkers, which in the best ships have a floor of cement, so as to minimise the danger from fire. At Aberdeen small English coals are largely used,* and instead of being piled loosely on deck at starting, as in some of the vessels from Granton, the extra coals are stored in bags, and are thus more easily handled. The finest vessels carry about 60 tons of coals in the side-bunkers adjoining the engine-room, and burn about 2½ tons per diem, with surface-condensing boilers; but fairly good ships often exceed this quantity.† The consumption of coal in such cases is, of course, a vital point in the economy of the trade, and a vessel which will consume 60 tons in 12 days is seriously handicapped. Some think that the larger vessels, which require more coal, are less fitted for remunerative work, since they catch no greater number of fishes. They might, however, be safer at sea. An improvement is the placing of the iron water-tank, which will hold about 270 gallons, under the deck, thus economising space and avoiding accidents. It is filled by a hose-pipe fixed to a screw-hole on deck. In the large screw-vessel from Montrose, the tank is placed behind the bulk-head of the engine-room, and a hand-pump raises water to the deck. In the newest ships an oil-tank, to hold from 40 to 50 gallons, is filled beneath deck in the same way.

The bulwarks of the new ships have self-acting scuppers for heavy seas, besides the usual small permanent ones, but no cement-gutters are now present at the sides, as it was found that they were rather a disadvantage, for, in such as have seen service, the cement becomes dilapidated. In 1884 the ships working off Aberdeen usually carried their fishes in covered compartments at the bulwarks in front, or even permitted them to lie loosely on deck. This arrangement is now seldom seen, probably owing to the use of ice and the greater distances traversed. The bag of the trawl containing the fishes is emptied in the Aberdeen ships in a series of pounds (about five in number), formed by passing stout planks into upright grooves on deck in front of the winch, and in these the fishes are sorted and 'gutted,' preparatory to being placed in the fish-hold

* At 11s. per ton.

† This is much less than the quantity consumed by some of the old paddle-ships in 1884, *e.g.*, about 35 tons a week.

in ice. The labour involved by this method is a contrast to that of previous years off the eastern Scottish shores. Hence, when the catch at night includes haddocks of from 8 to 10 inches in length, these are considered unremunerative to treat in this way, and are thrown overboard.

In the ships of 1884 the stout boat of the trawler was either carried on deck, or suspended from davits at the sides. They can be easily launched from the latter, but may be carried away, and, besides, the top-weight of the vessel is increased. At Granton the vessels formerly described have now placed their boats on strong iron rails, 6 feet 6 inches high, on the starboard side, and bolted to the engine-room on one hand and the bulwarks on the other. Now a larger boat in the newer vessels is placed on rests in the centre of the ship over the engine-room, while in the most recent it occupies the centre of the stern, and the front 'stock' or support has a swivel. Moreover, in the 'Belcher,' the hook of the chain-lashing is jointed and fastened with a ring, so that the boat can be made ready in a minute. The modern boat is considerably larger, and is covered with canvas.

In connection with the fittings on deck, the use of raised or projecting figures or letters of sheet-iron on the funnel is one of the modern changes; they are very easily seen at a distance. The initial letter of the owner is sometimes added. Each vessel is, of course, marked likewise on quarter and bow.

The ice-house, which had just been introduced in 1884, is now an important part of the vessel, usually in front of the fish-hold. Five tons of broken ice are taken in the larger vessels to the distant grounds. It is sent from the stores in barrels, and passed from the cart to the hold by a funnel. So important has this feature become both for liners and trawlers, in Aberdeen for instance, that special factories have been erected for the manufacture of ice by the ammonia system, about 20 tons being made daily in one* near the harbour at present, and extensions are in progress to manufacture 40 tons daily. On the distant grounds, where most of the work of the larger vessels occurs, the ice is placed over the fishes after they are 'gutted' and consigned to the hold, as was done by the English trawlers from the distant grounds in 1884. The price of ice (at present 17s. 6d. per ton) is thus an item of moment in the trawling expenditure. On discharging the fishes from Iceland, Faröe, or the Great Fisher Bank, the old ice is thrown overboard, and, though it might seem economical to keep it for use in a subsequent voyage, *e.g.*, for the preservation of the offal, for which 10s. per ton is got from the manure-companies, yet it is certainly the safer method. No wind-sails are now employed.

The fish-hold in the best ships is from 9 to 10 feet in height, divided into compartments, each with two shelves. In the 'Southesk,' a screw-vessel at Montrose, there are two holds. When fishes are stored with alternate layers of ice, the front of the compartment is closed with planks, unpainted or coated green with enamel-paint, which is readily purified by washing. The shelves, again, in each division, are useful in diminishing compression. This alone is a marked change on the Granton trawling-vessels of 1884, for the newest ships then had only an ice-chamber surrounding a central compartment in which the fish-boxes were placed. The smacks from Grimsby and other parts in England, it is true, used ice in the manner now described in 1884 and previously, but it was comparatively rare in Scotland at that period. It is necessitated now by the lengthened voyages to the more distant grounds. During the voyage the water which collects from the fishes and the melted ice is carefully pumped out by a 'donkey' engine, so as to keep the fish-hold dry. The

* Mr Lang's.

hold will contain about 700 boxes of fishes, and great care is taken to keep it pure. In the Granton General Steam Fishing Company's ships ice is not used during the winter, for the fishes can be carried fresh to the market by means of one ship acting as 'carrier' daily. In the warmer weather, however, ice in bags is taken on board each vessel. Few ships at Granton, indeed, have the compartments for packing the fishes in ice, with the slips of board for closing them. This shows that the majority fish in the less distant waters.

In some of the newest vessels the accommodation for all the crew is in the aft cabin, the fore part of the vessel being relegated to the fish-hold and stores. This appears to be a decided improvement in regard to the maintenance of a cool temperature and pure air near the fishes, especially when long voyages are undertaken. Formerly the crew had a fore-cabin, and the captain and mate an aft-cabin, and in many vessels the same arrangement still occurs.

The engine-room of the newer vessels is better ventilated, and the arrangements for the working of the engines facilitated. Even the ventilators are utilised for the hoisting of cinders from the hold by the aid of a small windlass. Moreover, in one the engine-room has an entrance from the galley as well as from the side, a convenience in stormy weather. A feature in contrasting the ships at Granton and Leith with those at Aberdeen is the small elevation of the engine-room above deck in the former.

In some ships the shrouds from the mizzen-mast are fastened to the deck about a yard from the bulwarks, so as to leave a clear space for working the trawl. In the larger ships, however, this is not necessary, the space in rear of the shrouds being sufficient for the trawl, or shrouds are altogether dispensed with, as in the Montrose paddle-ships, which have only a foremast.

The galley for the cook is in many under the bridge in front of engine-room, or in some in the forecastle peak;* but in the Montrose paddle-ships it, with the water-tank, is at the side near the paddle. These, also, have two tow-rails, one in front of the cabin for the crew, and one behind the cabin for the captain (aft), as the vessels are used for towing. A hand-windlass for raising the anchor is also present.

The average length of the trawl-beam in the best ships is 54 feet, it being found that a longer beam does not work so satisfactorily or catch so many fishes. At Montrose the beam is 52 feet. As before, it is composed of two or three pieces of oak or French elm, though occasionally it is in a single piece, and has a diameter varying from 10 inches to a foot. The shape of the iron trawl-head is scarcely altered, the posterior iron plate in a few being somewhat more abrupt than in 1884, thus conforming to the English type of trawl. The height of the beam from the ground varies from 3 feet 8 inches to about 4 feet. The 'Athole,' one of the General Steam Fishing Company's ships, is at present provided with an 'otter' trawl with gigantic wooden ends about 12 feet long by 5 feet broad, which take the place of the 'hammer' of the pole-trawl described by the Commissioners of 1863,† and which are simply the much-enlarged wooden ends in use in the otter-trawls in the Forth in 1858. These huge wooden (door-like) ends have on one side in front two powerful iron bars meeting to form a V, and supported by two accessory stays, the whole forming a projecting apparatus to which the chain connected with the warp is fixed. Towards the rear a perforated iron plate gives passage to two chains (one from each of the powerful iron

* The presence of a water-closet opposite, in one instance, appears to be objectionable.

† *Report, Sea Fisheries of the United Kingdom*, vol. i., Appendix, p. 3.

bars above-mentioned) for the attachment of the swivel for the trawl-net. The lower edge of the wooden end is weighted anteriorly with a heavy bar of iron, which occupies nearly half the length of the apparatus. A special and powerful rectangular frame of wood, with a top snatch-block, is fixed at the port-bow and taffrail for hoisting the ends on board; and they form a striking feature from a distance, as—with the boards—they project 6 or 7 feet above the bulwarks. The foregoing trawl is said to capture cod more freely than the beam-trawl, as many as 20 score having been secured in April. It is, however, still on its trial, having only been introduced about six months ago.

It was formerly pointed out that, when the iron trawl-head was dislodged, great difficulty was experienced in repairing it—especially in rough weather. The new trawls at Aberdeen have a broad band of iron which bends round the end of the beam, and on which the loop of the trawl-head goes. It is secured by an iron pin and safe. This sheath protects the end of the beam, and must save much time at sea. At Granton the ends of the trawls are guarded by flat iron plates, but they do not form a loop over the ends. The trawl-heads are secured by a pin, as already mentioned. In the finest ships the length of the trawl-net is about 118 feet, and the arrangement is as follows:—For the first 56 feet next the beam the mesh of the net is 3 inches from knot to knot; the next 38 feet has at first a 2½-inch mesh, diminishing to 2 inches towards the posterior end, while for 24 feet the bag or 'cod'-end of the trawl-net has 1½-inch mesh. At Montrose the trawl-net consists of 44 feet of 3-inch mesh next the beam, then 44 feet ranging from 2½ inches downwards, while the last 14 feet has 1½-inch mesh. There is thus no diminution of the mesh at the 'cod'-end. Moreover, no improvement in the shape of a 'bonnet' or apparatus for preventing the compression of the fishes has been found serviceable. The net has various rubbing pieces of old net and 'bass' ropes, and the usual pockets internally. The ground-rope is variable in composition. The majority have this part of the trawl composed of rope only—an outer layer being wound round a central rope. The ground-rope of the Montrose ships is of Manilla soaked in tar, 8 inches in circumference, and made up to 13 with others twisted round; and in the finest ships elsewhere it is 124 feet long. In some, two pieces of chain are inserted at the ends, thus making three divisions of the ground-rope, viz., a central, entirely of rope, and two lateral, with a centre of 18 feet of chain, each being tied to the other with spun-yarn. Ground-ropes with chain throughout are not now used. In certain ships the ground-rope has a centre of wire-rope with a series of wooden rollers, with occasionally, here and there, a pair of metal rollers (12 in all—Gunn's patent). The rope is also in three divisions, and costs about £6, 10s., or 30s. more than the ordinary form composed only of Manilla ropes. This arrangement is thought at Aberdeen to give an increased catch of fishes—sometimes about 5 or 6 baskets more than by the ordinary ground-rope. In some ships, again, the port- and starboard-trawls have each a different ground-rope; in the one the rope is all of one piece, whereas in the other three breaks occur, viz., two of wire and one of chain. In one ship, the ground-rope had only 8 feet of chain at each end, while the centre had rope. All, however, do not think that the rollers are so satisfactory as a ground-rope with pieces of lead in the centre. Moreover, one of the features which contrasts strongly with the condition in 1884 is the fact that the newest ships, with the exception of the Montrose vessels, now carry two trawls—a starboard- and port-trawl—complete in all respects. This arrangement has been in force for at least four or five years, and probably was introduced from England. At Aberdeen, however, the second trawl is, as a rule, used as a reserve-apparatus, and is not put into requisition until the first has received damage. The mode

of working the two trawls would thus appear to differ materially in the respective countries, since, according to an interesting paper by Mr W. L. Calderwood,* as soon as the contents of the first trawl are placed on the deck, the second is immediately 'shot' overboard. The same arrangement has been found at Grimsby by Mr Holt, who mentions, however, that the reserve-trawl is shot while the 'cod'-end with its fishes is still hanging from the tackle. The General Steam Company's ships at Granton (nine in number) have not varied in regard to the single trawl-beam, but they carry a second net. Consequently the large snatch-block and rollers occur on the port-side only. As before, the net is attached to the trawl-beam by grummet-lashings or by cord. The other parts, comprising the dandy and bridles (each about 25 fathoms) and the chain for the former do not differ materially from previous descriptions. The steel-wire rope is about the same length, viz., 200 to 240 fathoms, and lasts about ten months. The aluminium trawl-warp does not seem to have met with favour in Scotland. In some ships it is not, as formerly, left on deck after the check of wire-rope is fixed to the mizzen-mast, but carried outside the bulwarks, so as to avoid accident to the men. Those which, like the Montrose ships, use a Manilla rope (generally about 180 fathoms), require a new one every six months, the old one being utilised in preparing ground-ropes.

The shooting of the trawl is carried out in a similar manner to that of 1884, only there are no trawl-davits at the taffrail in the best Aberdeen ships; and, instead of the snatch-block then in general use, more convenient 'dandy' scores (snatch or tumbling blocks), of which Sudron's or Scisson's patent are the best. At Granton and Montrose the trawl-davits are still in use, with snatch-blocks on deck. The lid of the block is opened during trawling. The trawl-warp leaves the drum, passes round a capstan, and out through rollers, either on the port- or starboard- side, according to the trawl in use. Blocks on the mizzen-mast are still employed to hoist the stern-end of the trawl, and the fore-mast has a derrick. In 'shooting' the trawl the ship goes at full speed. When the 'cod'-end of the trawl is unshipped, the mate at the same time orders the fore-trawl-beam lashings to be freed, and when the beam is at right angles to the ship the 'stopper'-rope is let go, and the order 'ware forward' then sends off the trawl-warp from the drum.

A better arrangement now exists for assisting in unshipping the heavy trawl-heads, for these rest on a stout wooden platform about 18 inches high, and thus are easily swung over the rail; and, besides, the deck is saved from injury. In one or two ships at Granton larger platforms for the fore-end of the trawl have been fitted. In a new vessel, indeed, a square of plate-iron has been put on the deck at the point most injured by the trawl-head. In rough weather a chain fastens the trawl-head to the nearest iron stanchion at the bulwarks, and is used in bringing the front trawl-head on board. In the same way an additional chain at the stern-end is sometimes useful. In the Montrose paddle-ships the wheels for winding the trawl-warp (a Manilla rope) are below, and only the capstan is on deck. The latter (capstan) in some trawlers is made too high, and is wrenched out of its fastenings.

The trawl is usually down for five hours on the 'Great Fisher Bank' and other grounds, though trawlers working near home regulate the time rather by the nature of the bottom than anything else, in some cases spending as much time (three hours) in mending the net as in trawling on hard ground, or where wrecks and anchors occur. The trawling period, indeed, on hard ground is about three hours, on soft ground five hours. When productive ground is discovered, a 'dan,' or buoy, with a red or

* 'British Sea Fisheries and Fishing Areas,' *Scottish Geogr. Mag.*, Feb. 1894, p. 73.

black flag by day, and a white globe-light, close to the surface, at night, is put in the water to mark the spot, though it is liable to be carried away by other ships, and the lamp broken. This buoy has a pole, with heavy iron bars, at one end, and towards the other about ten flat pieces of cork, upwards of a foot square. In one or two ships floats of skin—such as the liners use in herring-fishing, with pole and flag, were substituted for the cork buoys, or small pieces of cork on a string. The rate of speed when trawling is, as formerly, about $2\frac{1}{2}$ knots an hour, though on muddy ground a higher rate is sometimes maintained. In sailing, the best ships go about 11 knots. At night the captain and mate take watch alternately—with one of the crew.

The crews on board the trawling ships remain very much as in 1884, the usual number being eight, though there are only seven in the Montrose paddle-ships, one of whom is cook. The latter may be either an old man or an adolescent. Each is furnished in the newest ships with a life-jacket of cork, and there are besides two life-buoys on deck. Only two at Aberdeen, the captain and mate, now have a percentage on the amount of fishes captured. The rest of the crew have ordinary wages. At Montrose the captain and two fishermen have a share in the 'catch;' the rest have wages. There are seven men on board the ships of the General Steam Fishing Company at Granton, instead of eight as formerly. The percentages given to each remain almost as in 1884, a graduated series running from the 'deck-hands' to the captain. The first engineer gets 5s., and the second 3s. 4d. per ton of fishes.

In 1884 the Granton General Fishing Company's ships used 'cringles' in transferring, during stormy weather, the fish-boxes to the 'carrier' for the day. This practice has now been abandoned, and the ships either run to quiet water, and place the boxes on the deck of the 'carrier,' or they are at once transferred by boarding. It is during the latter operation that considerable injuries occur to the bulwarks and rail of the ships, the former having the stays bent, and the latter being frequently driven in.

One of the newest ships * at Aberdeen is a steel vessel—with a well—for fishing at Iceland and Faröe. It is 103 feet between the perpendiculars, and 114 feet on deck, 21 feet broad, and $12\frac{1}{2}$ deep. The well is one of Houston & Mackie's patent fish-wells, and occupies the entire centre of the ship, the roof of the well sloping inward about half-way up the side of the ship, and leading to the hatches—the opening thus being much smaller than the bottom. The water accordingly will be somewhat steadied during the motion of the ship, though, as the cod will have a roof to rub against as well as walls, injuries may readily occur. The water is driven in during the voyage, rises to the surface of the well, and overflows by an opening in the side of the ship. A constant current is thus kept up. A grating at one end (the lower) permits the removal of refuse from the bottom of the well. While the cod swim freely in the tank, the halibut are tied, as usual, by the tail to the iron rail at the margin. The vessel has been specially fitted for the capture of these by hook and line; and at present no trawl is aboard, though such can be shipped at any time, and the newest apparatus (*e.g.*, steam-winch and Sudron's patent dandy-score) is in readiness. The foremast has a derrick-boom, and the anchor-winch is worked by steam. The boat rests on a swivel-stock on the port bow, and is intended to be used as an accessory well. The cabins for the crew (viz., captain, two engineers, and nine men) are at the stern, while in the high bow is a store, and behind a convenient hold for fixing on the bait (herring). An ice-house, fish-hold, and all the newest fittings in the engine-room and other parts show the care that has been bestowed on the

* 'Ocean Bride'—Mr Drummond's.

construction of the vessel. The consumption of coal is estimated at 3 tons daily.

Similar ships to the foregoing have been employed for some years at Grimsby for line-fishing in Iceland, but several improvements have been introduced in the new ship. Moreover, it can also be used as a trawler when required.

3. The Present State of the Beam-Trawl Fishery in relation to the Fishing-Grounds and the Fishes.

In 1884, under the head of 'General Remarks,' as careful a survey of the situation of the fisheries in connection with both line-fishing and trawl-fishing was drawn up.* In reading over these remarks at the present time the position does not seem to have been misunderstood; indeed, there is little at variance with the condition as now shown by ten years' experiments and observations. Amongst other remarks it is stated that 'steam-trawlers at present can only fish profitably within a moderate 'distance of the land; and were the fishes to become so thinned that, with 'all the skill and energy shown in managing the ships, the returns proved 'unsatisfactory, trawling might voluntarily disappear. There is no 'reliable evidence, however, that before such a result would happen 'irreparable injury would have been done to the sea-fisheries.'

Now, at that time there were in Scotland a total of 61† trawling-vessels—of which probably about one half were steamers, the other half being sailing-boats or vessels used for trawling. The exact numbers cannot be obtained, but there were from 12 to 20 boats used in trawling at St Andrews, 6 to 8 came from Broughty Ferry, 2 or 3 each from St Monans and Cellardyke, and others existed in the Moray Firth. Trawling, indeed, at St Andrews was an old custom, the Buckhaven fishermen having introduced it early in the century, and subsequently the local fishermen carried it on more or less regularly, generally trawling in September and October, and in March and April, though occasionally much longer. The frequent presence, however, just before the period of the Trawling Commission, of 10 or 12 powerful steam-trawlers to compete with them on their own ground quite altered the aspect of affairs. The energy with which the steam-trawlers generally worked—for trawling went on by night as well as by day, and in weather unsuitable for the liners—introduced in Scotland a new era into the department. Fishing was to be carried out no longer by more or less independent crews, bound together by blood-relationship or other ties, and whose working hours were largely regulated by the weather and tides, or their own convenience and necessities. Moreover, their whole domestic life was interwoven with the time-honoured pursuit. Their wives and daughters laboriously baited the hooks and arranged the lines in the baskets for 'shooting,' they gathered the 'bent'-grass for separating the layers of the line, and with the sons dug lob-worms or procured mussels for bait. In the olden time, indeed, their wives and daughters were likewise their fish-merchants, and disposed of their captures to the best advantage. Now (1883) active and powerful vessels, propelled by steam, and thus more or less independent of the weather—manned by a captain responsible to owners or their manager, a crew bound together only by discipline and pay, and whose fishing apparatus required no bait, appeared on the field. Further, instead of following the pursuit on grounds familiar to generations before them, the new fishermen not only

* Vide *Report of the Commissioners*, pp. 377-380.

† The numbers are taken from the *Report of the Select Committee of The House of Commons*, 1893, p. 396.

ranged over these, but sought new and sometimes more distant fields. Capitalists took up the question, and fitted out powerful ships in both Scotland and England, and sent them into Scottish waters, so that the liners met with most formidable rivals. The complaints of the line-fishermen at this period (1883) and subsequently necessarily attracted much attention, and great sympathy has always been expressed in regard to their condition, for undoubtedly the larger and more regular supply of fishes had a tendency to diminish prices, and this caused a reduction of income to the liner, and the fishes on certain of the nearer grounds were thinned, and perhaps rendered more wary. In the Report of 1884 it was said that 'two competitors are in the field instead of one, and for the liner 'it may take closer work, even with all the help improved modern appli-'ances in boats and material can give, to keep pace with his rival;' and further, that it would be a great calamity if any mishap should befall such a fine race of men—hardy, willing, and adventurous. Complete destruction, or, at any rate, most serious interference with the fishing-grounds, and the destitution of the fishing-population, was then predicted, and many anxious eyes watched the development of events, since about 45,000 men at least were dependent on the net- and line-boats of the country, whereas only a few hundred—perhaps between 200 and 300—were at that time engaged in the trawling industry.

Since 1884 the trawling vessels have steadily increased in number, so that within the ten years they have been considerably more than doubled: the returns for 1893 showing that there are no less than 142 vessels and 720 men thus employed,—the total value of vessels, exclusive of gear, being about £240,737. Or, to go more minutely into details, of this number 72 are steam-trawlers, having a tonnage of 2625 tons, and valued at £237,004, to which has to be added the fishing gear, £10,746,—making a total of £247,750. These vessels are manned by 544 men. The rest (70) are sailing-trawlers, having a tonnage of 423, and valued at £3733, while their gear is estimated at £1332—making a total of £5065, with 176 men on board.

In addition to the foregoing there were 39 steam trawlers belonging to English owners, fishing regularly from Scottish ports, and the tonnage of which was 959 tons, value £92,100, and value of gear £3850,—making a total of £95,950. These had 296 men on board. The disproportion between the number of men employed and the cost of the material is chiefly brought out when it is mentioned that for 1892 the liners and net-fishermen were 45,629, while they had 13,865 boats, valued at £680,000. It will thus be seen that, while the average is about £1695 for each trawling ship, for the liner it is about £49. The disproportion, again, in the trawling vessels, between the first-class and the small sailing-boat, *e.g.* of the Clyde, is very great,—the former being about £5000, the latter under £40.

If the returns of round, flat, and other fishes landed, irrespective of herrings, sprats, sparlings, and mackerel, which do not prominently bear on the present question, be considered, it is found that in 1892* the liners brought to shore 1,229,809 cwts. of round fishes, viz., cod, ling, torsk, saithe, whiting, haddock, and conger, which realised, at 8s. per cwt., £516,524; the trawlers landed 261,200 cwts. at 10s. 11d., or £143,062; the liners produced 100,228 cwts. of flat-fishes, viz., flounders, plaice, brill, skate, halibut, lemon-dabs, and turbot, at 10s. 9d. = £53,973; the trawlers, 77,649 cwts. of flat-fishes at 25s. 4d. = £98,295; while of other kinds of fishes, which include hake, bream, gurnard, cat-fishes, and sillock, the liners had

* The full value of the labours of the Royal Commission of 1883, and especially of the late Lord Dalhousie, in establishing a series of proper statistics for the fisheries of Scotland, cannot be over estimated.

61,224 cwts. at 4s. 9d. = £14,646; and the trawlers, 41,256 cwts. at 4s. 7d. = £9,410. The total in each case are, for the liners 1,391,261 cwts. and £585,143; for the trawlers 380,105 cwts. and £250,767.

In glancing at the returns (1892) of the Board, which were handed in by the Chairman to the Select Committee last year, it would seem that one fish, viz., the green cod or coal-fish, is included both amongst the round-fishes and the 'other kinds of fish,' in the former having the name of 'saithe' (adult), and in the latter 'sillocks' (young), but this is not a point of much importance in regard to the results. As might be expected, the liners, and notably the long-liners, have the predominance in the round-fishes, especially in regard to cod, ling, and conger, the latter being apparently seldom caught in a trawl on the Eastern coast. These large fishes, moreover, would appear to protect themselves to a considerable extent from this apparatus, especially when it is in frequent use, so that it is only in water that is disturbed by gales or by working at night that they are caught in numbers under these circumstances. Nor is this surprising, since even a tiny cod, of little more than $\frac{1}{8}$th of an inch, can avoid the forceps intended to capture it. The cod and saithe are also largely caught by gill-nets on the West coast; while the great lines, with hooks baited with herring, are the chief means of capture used in the case of the conger. Further, it has to be remembered that the trawlers, both near and distant, as a rule, throw overboard their small haddocks (8 to 9 and 10 inches), in both cases because it is not worth their trouble to bring them to market and pay dues for the trifling sum obtained for them; and in the instance of the distant trawler, to avoid, in addition, the labour of 'gutting,' and the expense of ice. Yet the liners bring these to market and they are included in their returns. It is an interesting fact that, notwithstanding the recent remarks concerning the condition of the trawled fishes, that the price of the latter surpasses that of the former by 2s. 11d. per cwt. It is true the trawler can more readily reach the market with his fishes, but against this has to be placed the great number of local fishing-boats which have only brief distances to traverse, and the fact that the trawlers who go to distant banks bring fishes 'gutted' as well as preserved in ice, and the appearance of which is not always in their favour.

When the flat-fishes are considered, it is found that though the liners produced considerably more in weight, yet the price obtained per cwt. is not half (by 3s. 10d. less) that got by the trawlers, so that the total value of the flat-fishes procured by the latter is nearly double that of the former.* Yet we know that halibut are largely caught by the liners, and that the three-mile limit and the closed waters in addition are at the disposal of the latter for relays of lines wherewith to capture plaice, dabs, and flounders. In all probability, however, it is the plaice, the witches, and especially the lemon-dabs and the turbot which prove so advantageous to the trawlers.

Of the 'other kinds of fish,' little need be said except that comparatively few hake come into the trawl, whereas the liner perhaps obtains a larger number; that while the liner brings the gurnards to shore and often eats them, they are frequently thrown overboard by the trawler; and that the cat-fish (wolf-fish) is caught by both in considerable numbers, but whereas, in certain trawlers, this fish is taken to port on the Tuesdays, it is thrown overboard at the end of the week.

In 1893 the equivalent returns show that the liners brought to land

* At Montrose, for instance, the flat-fishes landed by trawlers realised nearly 20s. per cwt., while those caught by line produced only 9s. 11d. per cwt. But turbot alone was sold at £3, 6s. 2d. per cwt., so that the trawlers had the advantage in this respect.

1,136,389 cwts. of round-fishes = £466,399, this being 93,419 cwts. and £50,125 less than last year. The most marked deficiency has been in haddocks, 69,766 cwts. and £35,092; cod, 54,260 cwts. and £20,661; and whiting, 15,381 and £5,741. An increase had taken place both in line- and trawl- fishing in the other round fishes, viz., ling, torsk, saithe, and in the conger caught by line. How far this diminution was due to the unfavourable weather of 1893 is an open question. It certainly must have had some influence. The abundance of very small haddocks is another fact to be remembered, since many were not brought to shore, and they occupied hooks on which larger fishes might have been caught. The trawlers landed 309,862 cwts. of round-fishes = £178,304, or 48,662 cwts. = £35,242 more than last year. With regard to flat-fishes, the liners produced 57,149 cwts. = £43,306, or 4,685 cwts. and £48 more than last year; the greatest increase, 5,594 cwts. and £566, having been in halibut, but these apparently were largely caught in distant waters, such as off the coast of Norway, Iceland, Faröe, and elsewhere, so that they confuse the returns from British waters. An increase also exists in soles (lemon-dabs?) of 50 cwts. and £120. A slight decrease, again, occurs in flounders, plaice, and brill. The trawlers landed of flat-fishes 71,024 cwts. = £89,781, a decrease of 604 cwts. and £7,243 on last year, this decrease being largely due to the deficiency of lemon-dabs, viz., 6,133 cwts. and £8,448, and a deficiency in turbot of 94 cwts. and £762, while an increase occurred in halibut and a larger increase in flounders, plaice, and brill, 5,197 cwts. and £1,597. This year skate form a separate return, which shows that the liners produced 52,626 cwts. and £10,725, or 4,862 cwts. more than in 1892, yet with only a trifling excess of income over that year, viz., £9, 10s., a result probably due to diminished prices. The trawlers landed 5,383 cwts. = £1,015, or 637 cwts. and £253 less than in 1892. Of 'other kinds of fishes' the net-fishermen brought 3,517 cwts. = £891, or 102 cwts. and £731 more than in 1892, while the liners landed 46,461 cwts. = £10,726, or 11,347 cwts. and £3,160 less than in 1892. The trawlers again caught 39,418 cwts. = £9,215, or 1,838 cwts. and £195 less than in 1892.

The price of the round fishes in 1893 is respectively for the liner 8s. 2½d. per cwt., and the trawler 11s. 6d., or a balance of 3s. 3½d. in favour of the latter, and therefore a higher proportion than in 1892. In regard to flat fishes the inclusion of skate makes a considerable difference; thus the average price for flat fishes, inclusive of skate, is for the liner 9s. 10d., for the trawler 23s. 9d. per cwt., whereas, when the skate are excluded, it is for the liner 15s. 2d., for the trawler 25s. 3d. In the former case the trawler receives no less than 4s. 1d., more than double the amount obtained by the liner; in the latter case the trawler receives 10s. 1d. per cwt. more than the liner. The disproportion in any case is marked. In connection with prices, however, it has to be borne in mind that in many cases the liner is compelled to sell his fishes in remote districts or unfavourable markets, whereas the trawler takes care to put his fishes into the best market, and in quantity.

Again, the grand total of all kinds of fishes landed in 1892 was 5,436,138 cwts. If herrings, sprats, sparlings, and mackerel (viz., 3,664,771) are deducted, 1,771,367 cwts. are left, of which 1,391,262 cwts were caught by liners, and 380,105 cwt. by trawlers, or, in other words, the liners caught more than three times the quantity of fishes landed by the trawlers. In 1893 the grand total of all kind of fishes notably exceeds that of 1892, and is no less than 6,208,018 cwts., or 771,880 cwts. more than in 1892. The greater proportion of this, however, is made up of herrings, viz., 4,486,187 cwts.,—that is to say, a fish which is more or less unprotected at all stages of its life is apparently able to hold its

own against its destroyers. It is, however, a purely pelagic form, and depends on the pelagic or floating fauna for its food. If the herrings, &c., are deducted, a balance of 1,721,831 cwts. is left for the liners and trawlers, being 49,536 cwts. less than in 1892. Of this 1,296,144 cwts. were the produce of the liners (less by 95,118 cwts. than in 1892), and 425,687 cwts. the quantity landed by trawlers (45,582 cwts. more than in 1892). While the liners, therefore, showed a marked diminution in their total, the trawlers showed a considerable increase.

When the returns, however, of the fishing-boats of all kinds (other than beam-trawlers) are considered, it is found that there were in 1893, 363 fewer boats and vessels than in 1892, and a decrease of 1689 fishermen and boys. This condition of things is sufficient to account for a considerable diminution of line-caught fishes, without regarding the unfavourable weather of the season. Moreover, it has to be remembered that fishery statistics are far from being complete, for though the returns show that the quantity of fishes mentioned has certainly been landed, they do not indicate those fishes which have been landed and not reported. On the other hand, the number of the trawlers has increased by 2 (probably powerful steam-vessels) and 18 men during the year.

In 1884 trawling was carried on within a 'reasonable distance' of land, so that the paddle-ship could deliver the catches of the night in time for the market next morning, or the daily 'carrier' of the fleet of steam-trawlers from Granton, by leaving the fishing-grounds in the afternoon or evening with the united catch, could reach that port early next morning. The vessels from the Moray Firth could land their fresh fishes at Macduff or Aberdeen, and the vessels from Montrose and Dundee carried fresh fishes to those towns.

For ten years the trawl-fishery has been prosecuted with vigour, and it is interesting now to see what areas the ships frequent, and with what results. To commence with the most northerly, viz., Aberdeen, at which trawling has made great progress since the former date (1884), it is found that, whereas the chief supplies were brought fresh from the adjoining sea by the older paddle-ships, or from the Moray Firth by the more powerful vessels, the main supply of the present day comes from the 'Great Fisher Bank' or from Iceland. Instead of the activity displayed in 1884 in the strip of sea from 10 to 20 miles off the coast, between Aberdeen and Montrose, only a few vessels are now seen at work here and there in good weather. Fishes are by no means absent from this area, and at certain times occur in considerable abundance, but the individual catches at other times are limited; and on the rough ground 10 or 11 miles off, in 33 fathoms, it sometimes happens that, after three hours' trawling, about the same time has to be spent in mending the net. Yet lemon-dabs and sail-flukes or 'megrims' (*Arnoglossus megastoma*) in the deeper and softer parts, with the larger haddocks and other forms, render the work there still worthy of attention. If small haddocks brought fair prices, the work would, indeed, be tolerably remunerative, as they are at present in very great numbers. The liners work on the same ground and catch chiefly the latter fishes. There is no indication that fish-food has been seriously interfered with on this ground, but, on the contrary, invertebrate life of all kinds is in great abundance. Moreover, the enormous numbers of pelagic sand-eels, from 15 to 33 mm. in length, intermingled with swarms of young flat-fishes, on these grounds, and on which many of the fishes were feeding in May, is a feature of moment. In 1884 the captures on the northern part of this area during the summer months were comparatively limited, and it was only the advent of the herring in autumn that caused a notable increase of white fishes. To-day, at the distance from land just mentioned, each haul in daylight produces from a basket to a basket and a

half of lemon-dabs, about three-fourths of a basket of large haddocks, and 4 to 5 boxes of small haddocks. At night, a few ling, cat-fishes, and cod are added to the catch. Few whiting are procured, and the same feature was occasionally seen in 1884, for the whiting are often in the upper parts of the water. Very few cuttle-fishes occurred in May. The 'catch' just mentioned is not a heavy one, and is probably surpassed by other ships, but it at any rate shows that fishes are still present in considerable numbers. This is further demonstrated by examining the 'catch' of a liner with six men on board, and which had been at sea about 32 hours, fishing on the 28th and 29th of May, probably from 28 to 30 miles off Aberdeen, viz., 9 boxes of large haddocks, the largest fish reaching the length of 20 inches, the rest smaller (at 24s. per box), 3½ boxes of small haddocks, a few cod, dabs, one lemon-dab, and a few whiting,—making a total of about £12 for the six men. In the same market lately the large haddocks brought 29s. per box, so that the above is probably not an unusual price.

At the southern end of the ground just mentioned, viz., off Montrose, a trawler working, three years ago, about 25 miles off, in August, landed the very high catch of 500 boxes of haddocks in a single night. At present the takes range, per week, from 100 to 140 boxes of haddocks and flat-fishes, besides cod, coal-fishes, and gurnards. Plaice are said to be rather scarce, even lemon-dabs being more abundant. For the night of the 29th May 18 boxes of haddocks and flat-fish were landed, besides cod and ling. For each box of good haddocks (7 stones) 16s. were obtained, a much lower price than in Aberdeen, where, however, the box was heavier (8 stones or more). The 'catch' for the night was about a ton in all. A small liner, with five men on board, which went out between 9 and 10 A.M. on the 29th, landed at 5 P.M. (*i.e.*, in 8 hours) ¾ box of large, ½ box of medium, 2 boxes of small haddocks, many about 9 inches long; 1 lemon-dab, 2 very fine cod, and 4 codling, and this though their lines were 'shot' in broad daylight. The fishing-ground was from 8 to 10 miles off. This is a small 'catch,' but the circumstances under which it was made were not favourable. There can be no doubt that the entire Eastern coast abounded with multitudes of small haddocks, and that these have been captured in immense numbers by both liners and trawlers.

The best trawling ships, which are about 30 in number, at Aberdeen at present chiefly frequent the Great Fisher Bank, about 200 miles off, and from 30 to 40 fathoms in depth, it being a general opinion amongst fishermen that this and up to 60 fathoms is the most favourable depth for their pursuit, for they think that in deep water (100–175 fathoms) they get only conger, halibut, and skate; and elsewhere, as off the coast of Portugal, only sharks are procured at 500 fathoms. Yet the Rev. W. S. Green, off the west coast of Ireland, got, 'witches,' ling, haddocks, and conger at 170 fathoms, and skate and forkbeard at 500 fathoms. On this ground (Great Fisher Bank), which is about 120 miles from east to west, and from 60 to 80 miles from north to south (a larger area than the inclosed region of the Moray Firth), the 'catches' of these trawlers vary from 80 to 180 boxes or more, consisting of plaice, haddocks, turbot, and other fishes, which are procured in from 8 to 13 days, including the time spent on the voyage. Since the Moray Firth was closed, these ships, therefore, find it remunerative to undertake this long journey, and bring their fishes preserved in ice to the market in Aberdeen. They do not seem, however, to find it so profitable to fish in the waters near the Scottish shore. In the same way, the powerful ships which proceed to Iceland bring from 200 to 400 boxes of fishes in about 14 days. The plaice procured in this region are recognised by the dark spots; and as these, the haddocks, cod, and other forms, have been 'gutted' and preserved in ice, they do not have so attractive an appearance as those caught by the liners.

Besides the areas just mentioned, some trawlers proceed to Blacksod Bay, off County Mayo, on the west coast of Ireland, for soles and turbot, while in February and March others go to ground 20 to 40 miles off Scarborough, where, perhaps, 20 score of cod are caught in a night. Some, again, work on the turbot-ground, from 80 to 90 miles off Aberdeen, and others find on the Dogger Bank catches of from 18 to 20 boxes of plaice.

When the trawlers from Granton and Leith are considered, it is found that, notwithstanding the closure of the Forth (for 3 miles beyond the Island of May), these ships have increased in number, have been improved in equipment, and have been able to overcome the difficulties with which they were handicapped—in comparison with the liners. In the case of the General Steam Fishing Company's ships, and probably in others, however, very definite instructions—based on carefully recorded data, compiled during the last twelve years—are issued to each captain as to the distance to be traversed (by the log), and the direction on every occasion. No haphazard selection of fishing-grounds is made. Thus in December, besides the ordinary fishes, numerous cuttle-fishes (so valuable for bait) are procured off the Isle of May. In January, February, March, and April they work from 5 to 10 miles S.E. of the Isle of May, viz., more or less on the grounds frequented in 1884. In March and April the cod are captured as before in considerable numbers as they congregate during the spawning season, and in the earlier months as they follow the herrings. In June, July, August, September, October, and November they take to the more distant grounds off the Forth—about 40 miles E. by N.E.

The opinions somewhat freely expressed by some in 1884 as to the decline of the trawling industry in the Forth and the adjoining area—notwithstanding all the advantages of a free area from inshore to offshore then possessed—do not seem to have been borne out by further experience. Even with the entire area of the Forth and St Andrews Bay closed, these vessels, now considerably increased in numbers, have found fishing profitable on the more distant grounds. They work on a certain area, either by means of a flag-buoy or otherwise, and strictly in accordance with the instructions given from head-quarters. If the captures are observed to be decreasing, either from the thinning of the fishes or their being scattered, they change ground, as, indeed, was very noticeable in 1884, returning after an interval to the same area, to find that an increase has taken place. In connection with this filling up of areas over which trawling has been assiduously carried on, it is an interesting fact that the local boats—from 12 to 20 or more in number—found for many years that, on the whole, their best ground in St Andrews Bay was a line about 2 miles from shore ('Scooniehill,' in a line with 'the steeples'), and about 4 fathoms in depth. Boat after boat trawled along that line, wind and weather permitting, for four months of the year, and sometimes longer, and to the closing day it maintained its position as the best area for plaice. The same observation has been made at Brixham, where trawling has been in operation about a hundred years. It is quite evident, therefore, that other fishes took the place of those captured, and that this continued month after month, and year after year. The whole question, therefore, in the larger areas outside the 3-mile limit is—Can the supplies from the neighbouring waters keep pace with the rate of capture now going on by both liners and trawlers? These supplies consist of the growth of the young from eggs on the area itself, and the immigration of eggs, young, and adults from other areas, or the open water beyond. It is seen that, so far as human observation can go, the supplies of herrings are as plentiful as formerly, notwithstanding the absence of restriction and the great waste that annually takes place in this fishing. On the other hand, it is a matter of observation that the first hauls of the

trawl on virgin ground are the most successful, and that by and by the catch diminishes, and the same occurs with the liners on their new 'banks' or 'reefs.' Yet it cannot be said in either case that the fishes have been extirpated, but they probably have become more wary as well as diminished in numbers, and, moreover, they may have changed their ground, for fishes are constantly roaming. It has to be remembered that the food-fishes are not altogether confined to the shallower water, in which they are usually followed, but they likewise extend into the deeper water beyond. Such deeper water and unfrequented regions, therefore, form reserves, in which the species is reproduced, the eggs, young, or adults passing into those areas in which the food-fishes have been more or less thinned.

The area last mentioned, viz., that off the Forth, is perhaps one of the most important in Scotland in regard to the number and variety of its fishing-grounds. For the present purpose the area may be defined as that bounded by a line drawn eastward from Arbroath on the north, and a similar line from St Abb's Head on the south. Between these points the Tay and the Forth pour considerable bodies of fresh water into the sea, while the Eden debouches into St Andrews Bay between them. The amount of microscopic food—both plant and animal—as well as of the smaller invertebrates which are carried to sea in this area, is very considerable, and, in all probability, is closely related with the richness of invertebrate life both in the waters and on the bottom. The enormous numbers of pelagic mussels swept from the Tay and the Eden alone form a remarkable feature. It is not surprising, therefore, that the fishing-grounds in this region still continue fairly prolific, notwithstanding the increased demands on their resources. In the same way the Moray Firth is another rich fishing-area on the East coast, though the rivers entering it are smaller.

The steam-liners and trawlers frequent the more distant grounds—not because the fishes are absent from the nearer grounds, but because their 'catches,' as a rule, far exceed in bulk those obtained on the latter. While, therefore, the present statistics show no serious diminution, it may be truly said that the total is kept up only by the supplies from Iceland, Faröe, and the Great Fisher Bank. But the nearer grounds would have produced a considerable supply if they had been perseveringly worked; and it cannot be doubted that they contained, at any rate, an immense number of small haddocks.* Moreover, these small haddocks had migrated from the distant waters, for it is a remarkable fact that, so far as ascertained, no great shoals of very small haddocks (*i.e.*, less than 3 inches) have been encountered in inshore waters. The life-history of the haddock, indeed, between its post-larval condition and the adolescent stage of between 2 and 3 inches, is still comparatively unknown. Before the appearance of these hordes of small haddocks, it was generally asserted that the haddock had been more or less extirpated; hence the necessity for caution in dealing with such subjects. Again, the question as to the completeness of the statistics of fishes caught round the Scottish shores has to be considered, and there are some who think much improvement is required in this direction. Indeed, the only satisfactory method would be for every liner, trawler, net-, crab-, or other fisherman to hand to the official on reaching the port a slip stating the amount and kind of the 'catch,' and the ground on which it was made, as indicated in the Trawling Report of 1884. Taking all these circumstances into consideration, therefore, there is no reason for despairing of the fisheries, especially when the enormous powers of reproduction of the round and flat fishes,

* An idea of the numbers of these may be given by stating that a trawler brought on board, in two hauls, about ten tons of small haddocks, which were, however, freed. Many were probably killed.

their transparent, floating eggs, and the vastness of the medium which encircles our shores are remembered.

The condition of the inshore waters (within the 3-mile limit) has elsewhere been dealt with,* and will again form the subject of future remarks. All that need be said at present is that, so far as can be ascertained, it would not appear that the closure of the inshore waters has made any marked increase in the fishes of the offshore waters, yet the younger fishes have now had time to pass outward and become mature; nor have the larger fishes been driven shorewards by the more frequent interference with the more distant areas. No change, however, could be expected if the scarcity were due to general over-fishing.

4. Effect of Trawling on the Invertebrate Fauna of the Sea-Bottom (forming Fish Food), and Collateral Relations with Pelagic Life.

The value of the bottom-fauna, in regard to the sustenance of the food-fishes, has been fully recognised by all zoologists. In the Trawling Report for 1884, it was stated *—'There cannot be a doubt about the importance 'of maintaining the invertebrate fauna of these parts (Forth) in a flourish-'ing condition, since upon this many of the food-fishes depend for much of 'their nourishment; indeed, both adult and young fishes could hardly 'exist without such, notwithstanding the abundance of herring and other 'pelagic food at some seasons.' †

In considering the effect of the trawl on the sea-bottom, it must be borne in mind that while many sponges, zoophytes, star-fishes, crabs, and shell-fishes are, in their adult state, inhabitants of the bottom, their larvæ and young are pelagic, that is, free-swimming, and quite beyond the reach of injury, so that were the majority of their parents killed and the sea-bottom rendered barren ‡ (of which, apparently, there is an absence of proof), swarms of the young would settle on the sites thus bereft of their predecessors. This interchange between the surrounding water and the bottom was pointed out in the Trawling Report, thus:—'The sedentary 'fauna of any such ground'—referring to fishing-banks—'brought up in 'the trawl, does not, however, give the whole explanation, for it has to be 'remembered that almost throughout the entire year a constant succession 'of eggs or young forms is given off by the inhabitants' (on the bottom), 'while there is another and less minute increment derived from the older 'forms which are forsaking pelagic life to settle on the banks.'§ It is the vast abundance of the pelagic fauna (which often has no connection with the particular ground examined), for instance, that is so important in regard to the food of the herring. Though every vestige of hydroid zoophyte ('sea-tree' of the fishermen) were removed from certain trawling-grounds, a single summer tide would carry into the area enough ripe little jelly-fishes (*Hydromedusæ*) to repeople it. The countless swarms of these beautiful glassy creatures which stretch for miles round our shores in the warmer months is one of the most striking features of the ocean; and, though the life-history of many has been ascertained, not a few have yet to be elucidated in this respect. From the eggs of the little pelagic jelly-fishes larvæ arise which by-and-by settle down on stones, shells, other zoophytes, and indeed upon everything that will afford a suitable hold,

* "A Brief Sketch of the Scottish Fisheries," 1882–1892, p. 6.

† *Op. cit.*, p. 370.

‡ *Vide* an interesting Essay on this subject by Mr Anderson Smith, *Trans. Highland and Agricultural Society*, 1890, p. 45.

§ *Report, Royal Commission on Trawling*, p. 370, 1884.

and rapidly grow into the plant-like original with which the cycle commenced, and which, perhaps, had been removed by trawl or hook, or swept on shore by storms. The rapid growth of such forms (*e.g.*, *Obelia*), as affect the salmon-ropes and stake-nets, is a familiar example. These ropes are only placed in the sea in May, and are removed in August, and long before the latter period they are feathered with the zoophytes (*Obelia*). Nature, herself, again ordains a similar check to the growth of another zoophyte, *Gonothyrea*, on the mussels of the Eden. This zoophyte coats the older mussels in the bed of the river with dense and graceful tufts, but towards October only the short stumps remain attached to the mussels. Previously, however, the spore-sacs have given origin to multitudes of pelagic young which by-and-by renew the feathery coating on the mussels.

It is worthy of record that it is not always easy to remove the fauna of the bottom whether by trawl, dredge, or net. Thus, a large zoophyte (*Corymorpha*), obtained in great numbers on the ground-rope and trawl-meshes of the 'Medusa' in 1884 in St Andrews Bay, has never been procured since —notwithstanding frequent efforts by trawl and dredge. Yet the free-swimming jelly-fishes (*Medusæ*) thrown off by this form are not uncommon in the Bay at certain seasons—showing that the parent-stock still remains. Again, the forms immersed in the sand are, for the most part, free from serious injury. This was pointed out, speaking of certain annelids, in the Trawling Report, as follows:—'The trawl has little or no effect on such 'as the foregoing, for their tubes in general are buried in the sand, their 'lives being passed in boring through it—for food and for shelter. So 'difficult is it to interfere with annelids sunk in the sand that one may 'sweep over a sandy surface, in which rare forms lurk, again and again, 'without discovering their presence. Even if a dredge is dipped, perhaps, 'only a head with its tentacles will reward the haul. Yet the sand may 'teem with them from 5 fathoms shorewards, and every spadeful—at 'extreme low water—may produce several. A single storm would appear 'to inflict greater destruction on these than it is possible to do by 'trawling.'*

A careful summary of the effects of the trawl on the sea-bottom and its fauna was given at the end of the chapter on the 'Fauna of the 'Trawling-Grounds in relation to Food-Fishes,'† and, with all the experience since gained, it is doubtful if any change can conscientiously be made. The only fact of moment to be stated is that it is several years since the West Sands at St Andrews have been so extensively covered with marine organisms in débris, as, for instance, in the spring of 1857, when the misty air was alive with hooded crows and gulls that fed on the stranded animals. Smaller numbers have been seen, but not the vast numbers of sea-mice, sea-urchins, star-fishes, shell-fishes, zoophytes, crabs, and other forms.

Besides the evidence (and there is much) of the capture and injury of the invertebrates in the trawl, and the consequent removal of part of the food of the fishes at the bottom, it is necessary to show that by constant trawling the sea-bottom is rendered destitute of nourishment for the food-fishes. Nature has provided in the case of such forms a remarkable power of recuperation, and a vitality that renders complete destruction difficult. Thus, the crushing and division of sponges is not followed by the death of all the fragments, and each of those which survives is capable of flourishing as an independent organism (not to allude to the liberation of ova which may happen to be present). The ordinary zoophytes are, as a rule, little affected by being carried on board ship, for, though in the

* *Report on Trawling*, 1885, p. 368.
† *Ibid*, p. 370.

more delicate, such as *Tubularia*, the soft polypites may fall off, they are reproduced when returned to the water. The very general provision of free-swimming buds which bear the reproductive elements is also a complete safeguard in the majority of this group, as already stated. Whence do the immense multitudes of the zoophyte (*Obelia*), which coats with a feathery forest every rope and buoy of the salmon stake-nets, come? Certainly not from the bottom, but from the myriads of minute pelagic jelly-fishes. A trawl which can simultaneously and completely remove the bottom-fauna and the free-swimming forms in the water would be necessary for the checking of such growths, amidst which other types lurk and feed—in turn to become the sustenance of fishes. Besides, young cod occasionally browse on the zoophytes themselves. Anemones are little injured by the trawl, for, as a group, the usual method of transporting them by post is to place them in a box amongst moist sea-weed. Moreover, crushing and division are not always destructive. Thus, it is stated, that in one of the West Indian islands a proprietor—wishing to extirpate a series of anemones, which attracted visitors, and so affected the amenity of his grounds—had the holes in the rocks, from which they protruded, bored by an augur, yet in a short time recuperation followed, and they expanded their beautiful disks as before. Each half of a bisected anemone becomes an independent animal. Again, the sand-dwelling forms, such as *Peachia* and *Edwardsia*, the latter occasionally eaten by flounders and dabs, have pelagic young which are swept in every direction by the currents, or sometimes are carried hither and thither attached to the disks of the swimming jelly-fishes. These forms are, indeed, doubly protected, since they live in the sand, and are seldom or never captured by the trawl, while their young are wholly pelagic. 'The masses of dead men's fingers (*Alcyonium*), though 'occasionally crushed, would, for the most part, survive after their presence 'on deck.'* The sea-pen (*Pennatula*), unless seriously crushed, readily survives—whether captured by trawl or hook, and would have no difficulty in again taking up its position on the bottom. The red coral of commerce has not yet been extirpated, though hundreds of boat's crews annually sweep the ground with their heavy bars of wood weighted with stones and fringed with hempen tangles just where their ancestors followed the same pursuit. The pelagic or free-swimming larvæ suffice to scatter and perpetuate the species, perhaps, before it grows so high, or protrudes so much as to come in the way of the apparatus. 'More decided injury is inflicted in many cases 'on the members of the star-fish group, which form no inconsiderable part 'of the food of the cod, haddock, and flat-fishes. Their brittle nature can 'ill withstand the rude trials of the trawl, and still less the trampling on 'the deck of the trawler, when the fishes are packed. All suffer more or 'less—the majority seriously; the forms most liable being brittle-stars, sea-'urchins, and heart-urchins.'† Such was the view expressed in the *Trawling Report*, and, though less pronounced than some more recent opinions, it appears to state the case not unfavourably for the opponents of the trawl. Thus, the sea-cucumbers, or Holothurians, often brought up from the bottom amidst stones and sea-weeds, are, for the most part, uninjured; and, since they can voluntarily eject their entire alimentary system, and, as the patient and persevering Sir J. G. Dalyell showed, reproduce it without serious inconvenience in about three months, they are not likely to suffer from the hands of the trawler. The cod is a more exacting marauder of the bottom in regard to the smaller Holothurians, since they are chiefly found in its stomach, and not in the trawl. The 'dreg' of the Zetlandic fisherman, as he searches for 'yoags' (horse-mussels) for bait, is also a more effective engine for the capture of the great 'sea-puddings,' as these Holothurians are called. While the brittle-stars are mutilated,

* *Trawling Report*, p. 370, 1884. † *Ibid.*, p. 370, 1884.

they are by no means in all cases killed. The disk produces new arms where they have been broken off, and even an injured disk is repaired. While many of the sand-stars are entangled in the trawl, the majority escape by being imbedded in the sand, as can easily be shown by using a dredge on the same ground over which many a trawl has passed. The sea-urchins suffer considerably by the trawl in certain regions—as, for instance, in the outer parts of the estuary of the Tay, and it is doubtful if many of those injured would survive. On the other hand, many fine examples frequent the rocky borders where no trawl can touch them. The delicate heart-urchins are, for the most part, ruined in the trawl, yet the habitat of many is deeply buried in the sand beyond the reach of 'sole'-rope or iron trawl-heads. Then, again, how many liners, how many mussel-, clam-, and oyster- farmers, would gladly subsidise the trawler to remove the swarms of common cross-fishes, whose multitudes form, for acres, a carpet on the bed of the ocean? They rob the hooks of the bait, injure the fishes after being hooked,* especially if any delay occurs in hauling the lines, and destroy vast numbers of oysters and mussels, not to allude to the trouble they give the liners in removing them from their hooks. The expensive measure of collecting them by hand, or by other means, on oyster- and mussel- beds, and placing them on land to dry in the sun, is occasionally only partially successful, since gulls carry them back to the sea before life is extinct. The old plan of tearing them across the body before returning them to the water only helped to increase their numbers, as the fishermen found that each portion of the disk was regenerated, and became a complete five-rayed star-fish. Again, the general habit in the group of producing countless larvæ which are pelagic, and which form a prominent feature in the tow-nets throughout the warmer months, is a powerful factor in perpetuating and widely disseminating them throughout the ocean, so that the vast expenditure of star-fish life in storms, or by the trawl, is borne with comparative impunity. The masses of the common brittle-stars on certain fishing-grounds is sufficient proof.

Not a few annelids, such as sea-mice, nereids, 'scale-backs,' serpulids, and nemerteans are entangled in the ground-rope and the net of the trawl, or in old shells and other débris from the bottom; but the injury to this group, as formerly mentioned, is not great, for many reach the sea alive amongst the débris, and regenerate lost parts or discharge their ova into the surrounding water, or the larvæ swim from under the scales or from the sacs. It is an interesting fact in this connection that certain annelids at the breeding season undergo a change of form, leave the rocks, cavities under stones, or other places of shelter, and swim freely in the water (that is, become pelagic), discharging their reproductive elements when thus *en voyage*. It is during these pelagic periods that the huge *Alitta virens* (a worm reaching occasionally about 3 feet, and a valuable bait for fishes) is thrown by storms in great numbers on the sands, even before the function for which nature ordained the pelagic period is performed. In the same way, Mr Scott, F.L.S., and Mr Duthie, recently found the inshore water at Castlebay, Barra, swarming with the sexual forms of a *Nereis*. An examination of the stomachs of food-fishes shows that such a provision as the foregoing is duly taken advantage of by them, and it is well, since the annelids are destined to perish after the escape of the reproductive elements. This subject was specially treated of many years ago,† and in the recent Reports of the Board further investigations have

* *Vide Fourth Annual Report of the Fishery Board*, p. 204

† *Invertebrate Fauna and Fishes of St Andrews*, p. 101, *et seq.* and also Dr Day in *Literature, Fisheries Exhib.* 1883.

been made by Mr Ramsay Smith.* Some annelids, again, are purely pelagic, like *Alciope* and *Tomopteris*, the latter being one of the most striking features of the tow-nets, both inshore and offshore, and frequently in great abundance. Moreover, like the masses of *Sagitta*, it is eaten by many food-fishes, and is another evidence that the question is viewed only from one side, when all the wealth of the pelagic fauna and flora, especially the multitudes that are independent of any particular inshore area, or of any land at all, is overlooked.

In 1884, after a careful and extensive inquiry, the effect of the trawl on the crab-tribe or crustaceans was given as follows :—'Like the star-fishes, 'the crustaceans are evidently damaged less by the effects of the trawl 'than by the feet of the men in gathering the fishes.' . . . . 'Many 'hermit-crabs, sea-acorns (*Balani*), and *Galatheæ* are returned to the sea 'alive. No injury to soft crabs was observed, and even so slender a 'form as the northern stone-crab, besides others, have been brought on 'deck in good condition.'† The most prominent form referred to was the Norway lobster, which occurs in great numbers off the Forth, and a caution was given that care should be taken to return it to the sea alive, for it is chiefly injured on deck, in selecting the fishes. This is a very important element in the diet of the cod in the neighbourhood, and measures should be taken for its preservation. The muscular parts of the abdomen form excellent food, but they are seldom brought to market. After hatching, under the abdomen of the female, the young of this lobster is pelagic, and is often found in masses amongst jelly-fishes off the Isle of May, forming a rich nourishment for the smaller fishes. Not a single lobster was observed in the trawl, and only from the inshore grounds, north of Aberdeen, were a few edible crabs obtained. The condition of the lobster- and crab- fisheries near St Andrews and Dunbar has improved within recent years, but how far this is due to the security from molestation which the crab-traps now have, and which has caused an increase in their number, or to other circumstances, is unknown. Taken generally, however, in Scotland, and so far as the statistics go, it is seen that there is a decrease in the quinquennial period 1888–1892 of 107,840 lobsters, and 2013 crabs,—from that in 1883–1887. The decrease, however, seems to be in no way connected with the trawling industry. Trawling close inshore with a small-meshed net (naturalists') often produces large numbers of swimming crabs, but such is a rare occurrence on board an ordinary trawler.

While, therefore, in trawling the injury to the crustaceans inhabiting the bottom is considerable, it has to be borne in mind that the pelagic crustacean fauna is one of the most marked features in the ocean, from the north to the south pole, and some of these, *e.g.*, barnacles attached to floating timber, sessile-eyed crustaceans, schizopods, and thysanopods are large enough to be the food of haddock and herring. Moreover, vast swarms of the smaller copepods nourish the younger food-fishes, and other types, again, are eaten by the larger fishes. Near the mouth of the Forth, at certain seasons (viz., in autumn), the water near the 'Hairst' at Crail is almost thickened by *Thysanoessa*, and the same form with *Boreophausia* and *Nyctiphanes*—all shrimp-like species of some size—occasionally is stranded on the beach in such numbers that it appears to be covered with a line of chaff. The tow-nets, under these circumstances, soon become filled with their masses. Some, however, may be disposed to treat the pelagic crustacean food, in connection with the nourishment of the fishes, with indifference, deeming such small animals of little moment in contrast with the more substantial denizens of the bottom. Irrespective of the circum-

* *Vide Annual Report of the Fishery Board for Scotland*, 1875.
† *Op. cit.*, p. 370.

stance that where they abound other and larger forms are in their wake, the fact that so gigantic an animal as the right, or whalebone-whale of commerce, lives solely upon such pelagic food in the Arctic seas, is sufficient to show how important an element this floating or swimming fauna is in regard to the welfare of the fisheries. The larger part of the masses in the tow-net, kindly used last year by Dr Allan of Glasgow on board the whaling-ship 'Aurora' of Dundee, consisted of the little crustaceans (copepods) above-mentioned, and this in the actual food-line of the whale as it swam to and fro in the water near an ice-pack. In our own waters, in addition to what is mentioned above, the sea-acorns, which so extensively cover rocks, stones, shells, and other structures within tide-mark, as well in deeper water (not to speak of those adherent to the skins of various whales) send off a multitude of free-swimming young which often crowd the inshore water, and extend far beyond before settling down on every available surface. Many other instances of the plenitude of crustacean pelagic life, and its adaptation for the nourishment of fishes, might be given, but sufficient has been cited to show that, besides the crustaceans of the bottom, those frequenting the water itself must be considered.

The ascidians or 'sea-squirts' of the bottom are occasionally brought up in the trawl attached to shells, stones, and sea-weeds; and such forms, along with pieces of 'sea-mat,' are not unfrequent in the stomachs of cod and haddock. They are usually sent overboard in a condition by no means unfavourable for existence, though it has to be stated that numerous pieces of adherent sea-mat are often brought to shore on the ground-rope and meshes of the trawl from certain areas. The young ascidians are free, swimming (tadpole-like), and escape interference till they settle on shells, stones, and sea-weeds. An interesting species in this group (*Oikopleura* or *Appendicularia*) is pelagic throughout life, and often occurs with its gelatinous 'houses' in dense multitudes in our inshore waters. It lives upon microscopic plants and similar structures in the water, while the smaller fishes and other forms prey on it.

The last group of the invertebrates liable to injury by the trawl is that of the shell-fishes and cuttle-fishes (Mollusca). In 1884 the opinion expressed was that, 'amongst the mollusks, the nudibranchs suffer a little 'on deck, but the cuttle-fishes are more delicate, the majority being almost 'lifeless on removal from the net. The horse-mussels are occasionally 'fractured, but the whelks are uninjured.' With the exception of water-logged wood bored by the ship-worm, horse-mussels, and whelks of various kinds, the majority of the shells were old and empty, either covered with growths of various kinds, such as zoophytes, or harbouring star-fishes and annelids in their interstices. As a rule, the horse-mussels were uninjured, and were consigned in safety to the water with the débris. On some of these such delicate organisms as the spawn of the Norwegian whelk (*Fusus norvegicus*), with the contained embryos in a thin capsule nearly an inch in diameter, were in perfect condition, and are now in the Museum. These mussels occur in deep water, and often form large masses bound together by the threads of the byssus or 'beard,' and are quite as frequently drawn up by the liners on their hooks on their particular ground. Moreover, some of the liners for years used to bring quantities close inshore and deposit them off the rocks, thinking to create a bed of horse-mussels, but all disappeared. Not a trace remains of the many tons of horse-mussels thus transplanted, except an occasional and solitary small example in a chink of the rocks, perhaps an inshore and last surviving descendant of the transplanted shell-fishes. The living whelks were generally entire, those (*Fusus*) having the rare anemone (*Hormathia*, the 'necklet') adhering externally, being in perfect condition, just as the much

more delicate dead *Natica*, overgrown with sponge, and tenanted by a hermit crab, often came up uninjured. Masses of the spawn both of the great whelk and *Fusus* are frequently brought up by the trawl, but much of these is uninjured on returning them to the water. Even on great stretches of sand, in which many shell-fishes abound, comparatively few bivalves are interfered with, since they are buried more or less under the surface, and afford little hold to the ground-rope. The molluscan fauna of muddy ground is also inconspicuous in regard to injury, the smaller forms, which are sometimes numerous, escaping entirely. A single severe storm dislodges those on sandy ground more surely and extensively than years of continual trawling. The spawn of the whelks, and that of the nudibranchs and cuttle-fishes, is more likely to suffer, yet only to a limited extent, since all is again consigned to the water; and even a somewhat lengthened exposure on deck is not fatal, if a little moisture be present, since many can be hatched after the arrival of the ship in port. In these remarks trawling over a mussel-bed, a clam bed, or over an oyster-bed, is not considered, since it is strictly and rightly prohibited. On the whole, then, the shell-fishes do not suffer conspicuous injury by the use of the ordinary trawl, a fact sufficiently plain at St Andrews, where the larger mollusks were eagerly sought for bait by the fishermen using trawls. It was only after a storm that a few were occasionally procured in a trawl, but they never failed to find multitudes strewn on the beach at the West Sands after a severe storm, of which, indeed, zoologists have frequent personal experiences.

Many cuttle-fishes, again, are captured by the trawl, and, as above mentioned, are, as a rule, killed. But these are carefully preserved for sale, and in certain cases form no inconsiderable item in the proceeds of the fishing, for a sum of money, varying from £1 to £5, is paid for each box of this valued bait. Further, the cuttle-fishes caught by the trawl are chiefly *Loligo* and *Ommastrephes*—squids as they are usually called. Now, these are pelagic or free-swimming cuttle-fishes that do not necessarily fall under the bottom-fauna, though, when captured, they are probably seeking their prey there, or in the stratum just above it. The occurrence of *Eledone* (a ground-form) in the trawl is less common than the foregoing. Moreover, the squids are mollusks particularly obnoxious in the active condition to liners, so much so that advice has been asked as to how to get rid of them.* They occur in such numbers now and then that the fishermen despair of their catches, for the cuttle-fishes so disfigure the haddocks and other fishes fixed on the hooks—by devouring the muscles behind the head—as to render them unsaleable. So eager are they, indeed, that they sometimes follow the hooked fishes to the surface, as the lines are hauled, and are captured by a hand-net. Opinions, therefore, might differ as to the disadvantages of thinning this group of mollusks, which, when full-grown, are as much destined for the nourishment of the whales as the food-fishes, though they are also eaten by larger examples of the latter (*e.g.*, the cod), and in their younger stages by many others.

The case of the molluscan fauna of the bottom as food for fishes in relation to the action of the trawl, however, cannot be considered without the pelagic or free-swimming representatives of the same group on the particular ground. Almost all the shell-fishes living on the bottom send off pelagic young, which crowd, throughout the greater part of the year, the region over the bottom, and ascend to the surface. Swarms of purely pelagic forms, such as *Spirialis*, which, small though it be, is often eaten by ducks at the surface, and more abundantly by many young fishes near the bottom, are mingled with these and the larval nudibranchs,

* *Vide Fourth Annual Report of the Fishery Board for Scotland*, p. 204.

and occasionally even with *Clione*. The latter does not attain the bulk of the arctic examples, but is by no means infrequent at certain seasons. Finally, the proximity of a mussel-bed, or the presence of an extensive coating of small mussels on the rocks, fills the water (June and July) with myriads of pelagic mussels, which by-and-by adhere to everything affording a surface, and form a favourite food of young fishes, and even of some of the adults.

Irrespective of its direct relation to fish-food, this unceasing wealth of pelagic life has a close connection with the sustenance of the bottom-fauna. Every invertebrate group, mentioned in the foregoing paragraphs, feeds on the pelagic fauna or its débris; for, even the highest—viz., the cuttle-fishes—frequently devour the pelagic fishes. The whole system forms a wonderful cycle, and is far more important, from a fisheries' point of view, than at first sight appears.

In returning the contents of the trawl to the water, many forms are doubtless devoured by fishes in their descent to the bottom, just as the gulls which follow the herring-boats in the western lochs, or the wake of a trawler on the eastern coasts, swoop on the offal thrown overboard, or on the injured fishes which escape from the net at the surface when hauling. The same remark applies to the invertebrates thrown over board by the liners.

5. Effects of the Hooks of the Liners on the same Ground.

In considering the effect of the trawl on the animals frequenting the bottom of the so-called fishing banks, it must be remembered that for ages the hooks of the liners have brought from the same banks representatives of every group of invertebrate animals, and that they are not always replaced in the sea alive. To the hooks of the liners, and also to their ready courtesy, most of the museums in this and other countries owe much. Some of the finest sponges in British waters, and the beautiful Venus's flower-baskets and glass-rope sponges abroad have been procured in this way. A constant and large supply of hydroid zoophytes ('sea-trees') is almost daily brought on shore from the deeper water. Some of the largest and finest anemones—studded, it may be, on the mandible of a small rorquhal, on a piece of submerged wood, on flat or other stones, on shells, or even on the thigh-bone of an unfortunate sailor—are similarly procured, along with stony corals and other coral-like structures (Polyzoa). If the trawler is accredited with the destruction of the great sea-pen (*Funiculina*)* of the western waters, what is to be said of its ruddy ally (*Pennatula*), the 'pink' of the eastern fishermen? Almost every hook for considerable portions of lines on certain grounds bringing up its example, and this not by any action on the part of this pretty sea-pen, but simply by the force of the tide on the line as it drags the hooks over the surface of the soft ground. Several jars have been filled in a single trip with these from such sources, and yet no scarcity of them exists, nor is it hinted that the cod directly, or the haddock indirectly, will be robbed of its food. In the same way fine masses of 'dead men's fingers' (*Alcyonium*), the slender sea-pen of the Forth (*Virgularia*), a rarer and larger type new to this country, and other forms, are captured by the liners.

Before and since the days of Edward Forbes the liner has been the mainstay for many rare star-fishes, and those who, like the genial naturalist just mentioned, have eagerly waited in the dim morning light—with the

* The late lamented Professor Milnes Marshall thought that the cod had a particular fancy for these great sea-pens, biting the tips as it swam amidst the phosphorescent stems, and leaving many in a truncated condition

ready pail of fresh water, or, still better, with the jar of strong spirit—for the advent of the brittle *Luidia* on board will appreciate the services of the fishermen in this respect. The daily captures of the common cross-fishes by the liners amount to a great annual total, yet such is unavoidable, and, indeed, the species is a pest to both the liner and the shell-fish farmer. As already said, it is the liner who procures many of the smaller holothurians, and who first made us aquainted with the rarer heart urchins and sea-urchins (*e.g.*, the 'piper').

In the group of the worms, one of the most gigantic Nemerteans (3 feet long and nearly an inch broad) has hitherto only come from the liner, and even the black line-worm is occasionally caught on the hooks. In the débris from deep-sea fishing-boats many of the rarer bristled annelids have been procured, and serpulids, the coral-like masses of *Filigrana*, and many others, come from the same method of fishing. It is an interesting fact that neither liner nor trawler has ever captured the characteristic spoon-worm (*Echiurus pallasii*) of St Andrews, and that storms alone toss them in multitudes on the beach. Food-fishes, however, find them out, and feed on them in their haunts.

If we regard crab-and lobster-fishing as a branch of the trade of the liner—and it apparently has little connection in any respect with the trawler—the effect of other instruments than the trawl in reducing the number of these animals is conspicuous. The larger forms by-and-by become rare, and all become fewer. There is no proof that the trawl ever seriously affects either species, but its use, close to rocky borders in bays, may occasionally in former days have interfered with the traps. The hooks of the liner now and then capture both species, and furnish many hermit-crabs in shells, Norway lobsters, some of the rarer long-tailed forms (*e.g.*, *Munida*), and many of the short-tailed crabs (*e.g.*, *Atelecyclus* and *Eurynome*). The hooks, likewise, bring up branches of submerged trees, coated with large sea-acorns, and affording shelter around the feathery tufts of zoophytes to many small sessile-eyed crabs.

Fine masses of sea-mats and bunches of sea-grapes (Ascidians) are very common on board the liners, the hooks penetrating the tough tests of the latter (Ascidians) as the lines are carried by the currents. Only from the liners are the curious and rather rare 'sandy-nipples' (*Pelonaia*) procured—another of the remarkable forms characteristic of St Andrews. Hundreds are sometimes brought on shore, the drifting hooks having penetrated the thinner superior part of the test as the creature was plying its respiratory and nutritive currents on the bottom. None have yet been obtained from the trawl, for the ground is rough. The multitudes of dead shells brought up by the liners have been one of the richest fields for the encrusting forms of this group—such as *Lepralia*, the foliaceous —as *Eschara* and *Retepora*, and the more or less ramified *Cellepora* and *Serialaria*.

When we come to the group of the shell-fishes or mollusks, the great variety that have been obtained from the hooks of the liners for hundreds of years is noteworthy. No collection of marine shells, worthy of the name, and made long before trawling was introduced into Scottish waters, exists—but is a standing proof of the fact that the hooks are almost as effective in furnishing rare specimens as the trawl. Some of the smaller forms, indeed, are more surely obtained in this way than by the trawl. Many are found in the débris attached to the masses of horse-mussels so frequently brought up from the bottom, others are fixed to dead valves of the larger shells, or have their siphons, foot or other parts, pierced by the hooks. On the zoophytes brought up by the lines, such naked forms as *Doto*, and, on *Alcyonium*, *Tritonia plebeia* are found in numbers, while the larger *Tritonia Hombergii*, "a sea lemon," is occasionally pierced by

a hook as it drags over the bottom. The active cuttle-fishes do not seem to be frequently caught by the hooks, though, when attacking the fishes on the lines, or interfering with bait, an arm or other part is now and then fixed. In contrast with the trawl, however, few cuttle-fishes are captured by the lines.

It is by no means to be supposed from the foregoing remarks that any blame is to be attached to the liner for interfering with the bottom-fauna. The notion would be unwarrantable. In the course of his operations the forms indicated have been unavoidably hooked, and he brings them on shore or throws them overboard without giving much heed to them, unless requested to do so. No marine zoologist of note would consider, on this head, that the liner was ruining the food of fishes, or to any extent affecting the welfare of the fisheries. On the contrary, his ready courtesy and keen observation have been frequently of the greatest service to the naturalist, who has been in the past, and is in the present, greatly indebted to him for many rarities. Yet the fact remains that the liner likewise captures numbers of every group whose wholesale destruction is by some attributed to the trawler. A calm survey of the situation, therefore, does not lend support to the notion that the trawl, as ordinarily employed in sea-fishing, is the only destroyer of the invertebrate animals of the bottom; and, further, experience does not demonstrate that the sea-bottom in any known region has been, by the use of such line or trawl, so seriously impoverished as to be unable to support fish-life.

6.—Effects of the Trawl on the Eggs of Fishes, on certain Ground-Fishes, and very Young Fishes on the Bottom.

In the Report of 1884 it was stated that 'no feature was more remarkable in the inquiry that the rarity of fish-spawn (eggs) in the trawl—'notwithstanding the careful search for such on very occasion.' A few zoophytes, with clusters of adherent eggs—then considered to be those of the herring—were all that could be found. Accordingly, it was reported 'that the trawl is almost innocuous so far as the ova of fishes is concerned;' and doubt was expressed, even if it passed over masses of the eggs of the herring, whether injury would always take place.

It has frequently been stated that the use of the trawl on the spawning-grounds of the herring, drives away the herring and injures the spawn and spawning fishes. No details, however, are given as to whether line-trawling or beam-trawling is referred to, nor are the facts dealing with the destruction of the spawn and the lesions of the spawning fishes presented in a tangible form. The herring is a fish sometimes exceedingly tenacious of purpose, and a thousand intervening boats with their nets, as at Peterhead, will not prevent it from breaking through and spawning inshore. Again, it has been known to leave old spawning-grounds, *e.g.*, the 'Old Hake' off the coast of Fife, upon which no trawl ever descended, or indeed could descend with safety. Many reasons have been given for such changes—from the breaking up of the shoal by the boats at sea, to the firing of big guns—but there is a lack of definition. In the Trawling Report of 1884, it was recommended that trawlers (*i.e.*, beam-trawlers) should avoid shoals of herring, and the same suggestion holds to-day.

Since 1884, no opportunity of observing the effect of a trawl on ground covered by the spawn of the herring has occurred. The boats employed in herring-fishing in winter, however, frequently bring to port masses of the spawn of the herring on their decks, and little difficulty is found in hatching these eggs in the Laboratory, even after sixteen hours' exposure

on deck. Thus, even if the eggs of the herring were brought on board during the operations of the trawl, there are good grounds for believing that many would survive after being replaced in the water. In St Andrews Bay the local trawlers formerly brought to land pieces of sea-weed, zoophytes, and similar structures to which the eggs of Montagu's sucker and other forms adhered. These were all readily hatched in the Laboratory. The same eggs are frequently brought up on the hooks of the liners. Further, about the middle of January 1886, one of these local trawlers brought a huge adherent mass of large eggs amongst mud to the harbour—thinking it was the spawn of the salmon. After lying on deck a considerable time, the attendant removed the mass from the mud and débris, rather rudely tore it in several pieces, and placed them under sea-water—some of the advanced embryos escaping in the process. The majority of these eggs were hatched, and the larval fishes were vigorous, and enabled an account to be given of the development of the wolf-fish ('cat-fish' of the fishermen), to which it was found the eggs pertained. At least once since the same eggs have been brought up in the trawl (from the Forth) about the period of hatching. It was rare to find, even in such sandy bays as St Andrews, that the egg-'purses' of the thornback or other forms were brought in by the trawl, though many containing embryos are stranded on the West Sands after storms in October, and especially in November. Such eggs are at least as frequently procured on board the liners, *e.g.*, those of the grey starry and sandy rays. Before the spawning of the sand-eel was fully elucidated,* it was often a matter of conjecture as to how it escaped the small trawls on inshore ground; but now the eggs are known to be adhesive—probably to the sand, and thus escape interference.

The ordinary trawl, again, seldom or never retains such active ground-fishes as the smaller rocklings, the gobies, the gunnel, the eel, and the sand-eel, while the glutinous hag and the lamprey are almost unknown in it. The hag-fish is, on the other hand, caught abundantly by the liners when they shoot their lines too near a well-known 'hole' south-east of the Island of May, and the lamprey occasionally adheres to a fishing-boat. When the trawl is used on hard ground, wolf-fishes are often captured, but they are as common on board the liners on the same ground. Similar remarks apply to the dragonet on soft ground, and perhaps it is more frequent in the trawl than on the lines.

If a trawl were to pass over masses of the spawn of the herring at the moment the young fishes were escaping, the ground-rope and other parts would certainly do serious injury—just as a sweep-net on the rivers would to the tender young salmon lying with the large yolk-sac amongst the gravel of the spawning bed. A wound of the yolk-sac alone is generally fatal. The extraordinary multitudes of tiny young herrings (of the thickness of thread) occasionally carpeting square miles of the sea—in St Andrews Bay, for instance, in March, would indicate the propriety of protecting them from all interference on this head, especially as they are then frequently just above the bottom. The very young sand-eels in the same way are often in great numbers just over the bottom, and, as this fish is perhaps next to the herring, the most important food-supply for the more valuable food-fishes, it likewise should not be interfered with. The enormous numbers of sand-eels on certain fishing-banks is one of the features of spring, and they are often mistaken by the fishermen for young herrings. The habit of the adult in burying itself in moist sand at and near low water is another illustration of the fact that a trawl may pass frequently over the same

* *Vide Ninth Annual Report Fishery Board for Scotland*, p. 331, and Dr Fullarton's paper on the Oviposition and Growth of the Sand-eel in the present Report.

area, and yet leave, irrespective of those that escape through the meshes, a considerable number of animals untouched.

In the course of the ordinary trawling on the fishing-banks, no indication of the great number and variety of the post-larval and very young fishes is obtained. They are swept through the meshes, or otherwise escape. Yet, on sinking the great triangular mid-water net to within a fathom or two of the bottom, or by using the bottom trawl-like tow-net, crowds of the post-larval and very young food-fishes—flat and round—are captured; for example, those of the long rough dab, lemon-dab, top-knot, ling, frog-fish, gurnard, dragonet, herring, and other forms. Neither trawler nor liner would seem to interfere at the stages indicated with these on such areas. In the same way, on other grounds, vast numbers of the young sand-eels, from 15 to 40 mm. (that is, from $\frac{5}{8}$ to $1\frac{9}{16}$ inches long) occur in the surface-nets in May, of which the only knowledge hitherto obtained was from the mouths of the fishes captured by liner or trawler, as neither interfered with them directly or indirectly in the pursuit of his calling.

The young fishes, on escaping from the pelagic eggs, are at first helplessly borne hither and thither by the currents, but the nature of their pigment, or even their transparency in most cases, probably proves protective. They are incapable of seeking shelter anywhere for a considerable time. When the flat fishes descend to the bottom their protective pigment on the upper side so closely mimics the sand or mud which they frequent that they are independent of growths, such as zoophytes or sea-weeds.* The very young round fishes again keep to the open water until they are of some size, and do not seem to seek either food or shelter at the bottom, and thus do not come in the way of the trawl. As they get older, many, such as the cod, coal-fish, and pollack, approach the rocky margins, swimming actively amidst the forests of tangles and other sea-weeds, and feed on the abundant animal life in that region. There they are also freed, for the most part, from interference by man.

* These young flat-fishes swarm all round our shores in April and May, on sandy and muddy flats, shallow rock-pools, estuaries, such as the Eden, and in the Swilcan burn as it debouches on the sands at St Andrews. They also, however occur in the deeper waters.

III.—AN ACCOUNT OF THE SEA-FISH HATCHERY AT DUNBAR. By Dr T. Wemyss Fulton, F.R.S.E., Superintendent of Scientific Investigations. (Plate I.)

In previous reports mention was made of the sea-fish hatchery which has been in course of erection at Dunbar, with the view of enabling the valuable food-fishes to be dealt with on a large scale, and great numbers of their young to be placed on the fishing-grounds. This hatchery was completed early in the spring of the present year, and active operations in the hatching of flat-fishes have been carried on in it since that time. A detailed account of these operations, by Mr Harald Dannevig, who was placed in charge of the hatchery, will be found in this report (p. 210). When the Board decided to proceed with the erection of a hatchery for sea-fishes, the writer visited the well-known establishment at Flödevig, near Arnndal, and subsequently prepared a scheme for the erection of an establishment at Dunbar as far as possible on the model of the one in Norway. Captain Dannevig, the director of that institution, came to Scotland and visited the proposed site at Dunbar, of which he approved. This particular part of the coast was selected for a hatchery for several reasons, the most important of which were that the water was found to be well suited for the hatching of buoyant fish-eggs, and that the Magistrates and Council of Dunbar had cordially granted the use of certain adjacent sea-creeks necessary for the full success of the work. Dunbar is also within convenient distance of important fishing-grounds, and in the neighbourhood of the sea areas where most of the scientific fishery work has been carried on; and where, therefore, the influence of fish-hatching may best be ascertained.

The site of the hatchery (Pl. I. fig. 1) is close to the Victoria Harbour, adjoining the old castle of Dunbar. The greater part of the buildings is situated within the Castle Park, on ground the use of which was granted for the purpose by the War Office, to which it belongs; the remainder is placed on ground adjacent, with the consent of the Magistrates and Council of the burgh. The hatchery consists of—(1) the hatching-house, in which the special apparatus for hatching the eggs is placed; (2) the spawning pond, which contains the spawning fishes when the work is going on; (3) the chamber in which the fish eggs are collected, and the water which supplies the hatching-house is filtered; (4) the house containing the pumps and boiler; (5) the tidal pond, to serve for the retention of the spawners until the actual hatching work begins, and thereafter as a reservoir of filtered water for the hatching apparatus. The position of these parts may be seen on the plan (Pl. I.). During the progress of the work Professor M'Intosh has on various occasions visited the hatchery, and has given the benefit of his great experience in the arrangement of many matters connected with it. The working plans, and the Plate accompanying this paper, were prepared by Mr A. D. Melville, Dunbar.

1. The Spawning Pond.

This pond (Pl. I. figs. 2 and 3) is constructed of concrete, from plans prepared by Messrs Strain, Robertson, & Thomson, C.E. It is a very strong and solid structure, placed at a higher level than the other buildings, and sunk in the ground. The best London-made Portland cement was used, the

test-bricks being capable of standing a tensile strain of 350 lbs. to the square inch. The pond is 40½ feet in length by 11 feet 2 inches deep, the breadth at one end is 26½ feet, and at the other end 18 feet, the variation in the breadth being due to the nature of the ground. These measurements refer to the dimensions inside. The walls are all 4 feet in thickness for the distance of 5 feet from the floor, except that at the broader end, which is placed against a cliff; one of the walls is 4 feet thick all the way to the top, the other two, which are heavily embanked outside, diminish in thickness to 3 feet, and finally to 2 feet. The bottom is also formed of concrete 18 inches thick, placed mainly on solid rock, and partly on a concrete arch, where the foundation was soil. A large amount of excavation, both of rock and soil, was necessary to prepare the foundation. The capacity of the pond is about 10,060 cubic feet or over 62,000 gallons. It is situated at a distance of 27 feet from the hatching-house, and on a higher level than the latter, so that the head or flow of water might be ample, as is explained later. The difference of level is such that the floor of the hatching-house is nearly 6 feet lower than the bottom of the pond, and the level of water in the pond, when it is full, about 15 feet above the level of the hatching apparatus, and about 10 feet above the upper edge of the water-wheel. The spawning pond is enclosed by substantial wooden walls, resting upon and securely bolted to the concrete, and it is covered in with a roofing of galvanised corrugated iron, resting upon eight strong couplings. The roof is lofty and capacious, and provided with eight skylight windows made to open, and which may be darkened when required. The upper surface of the concrete walls forms a convenient marginal pathway. A door is placed at the north-west corner, opening to the outside, and at the north-east corner the pond-house is continuous with the spawn-collecting and filtering chamber.

The feed-pipe by which the pond is supplied with sea-water is carried from the pumps along the top of one of the concrete walls to the south-west corner, or that furthest from the spawn-collector, where the overflow takes place (fig. 2). Here it descends for 5 feet into the pond; but the terminal sections of the pipe being movable, the water can be poured in at any level. In order to empty the pond or lower the level of the water as desired, two 4-inch galvanised iron pipes pass through the bottom of the wall next the hatchery. They are placed 6 feet apart, and are united outside to a fireclay drain-pipe 6 inches in diameter, which is embedded in concrete, and runs to the harbour, receiving on its way all waste water from the water-wheel, hatching-house, pump-house, &c. It was deemed advisable to have two outflow pipes to diminish the risk of the accidental stoppage of one. Each of the outlet-pipes is controlled by a gun-metal cock, which may be opened and shut by means of a galvanised iron rod attached to it, and worked from above by a key (fig. 3). On the bottom of the pond, lying loose on the concrete, there is a system—or rather two systems—of branched perforated piping, of diminishing diameter, and made of galvanised iron. One of these systems occupies one-half of the floor, and is connected with one of the 4-inch outflow-pipes; the other lies upon the other half of the floor, and communicates with the other outflow-pipe. The object of this arrangement is to allow of the bottom layer of water (which soonest becomes tainted) being rapidly drawn off without unduly depressing the level of the water in the pond. Above these pipes, about 18 inches from the concrete, a flooring of smooth boarding is placed, spaces being left between the boards in order to allow excrementitious matters, remains of food, &c., to pass through, when they may be quickly removed in the manner just indicated. It is upon this wooden flooring that the flat-fishes rest, and its height from the concrete floor, as also the width of

the spaces between the boards, may be varied according to the species of fish being dealt with, or as other circumstances indicate. Three 2-inch galvanised iron pipes are carried at different levels, but in the same vertical plane, through the wall of the pond into the filtering-chamber (fig. 3). One is 3 feet, the second 6 feet, and the third 8 feet above the concrete floor. By means of these pipes, water can be drawn from the pond to drive the water-wheel or supply the hatching apparatus during the night, or at any other time, and this arrangement has been of the greatest service.

As has been said, it is into this pond that the adult fishes, males and females, are placed at the spawning time. The spawning process, the ejection and fertilisation of the eggs, goes on naturally as it would in the sea, and the fishes require only to be fed and supplied with sufficient water to keep them in good health. The eggs, being buoyant, rise towards the surface, and are carried by the overflow from the pond into a special apparatus, the 'spawn-collector,' where they are retained while the water passes away to the water-wheel: the spawn-collector might be called the egg-filter. Its construction is as follows:—A horizontal wooden shoot, 3 feet in breadth and 8 inches deep, is let in to a corresponding depression in the top of the concrete wall. It is about 6 feet in length, and passes into a large rectangular horizontal wooden box, 6 feet long, 4 feet broad, and 16 inches deep, which may be considered an expansion or dilatation of the shoot. From the other end of this box, the shoot which takes the overflow water to the water-wheel passes. Within the large box described is fitted a movable wooden frame, open towards the pond, but covered on the sides, bottom, and other end with hair-cloth, and projecting above the level of the water. It is so arranged that a space is left all around and below it. The object is to form a filter, with a large surface, in which the eggs will be retained, while the flow of water through it is comparatively gentle, and does not subject the collected eggs to injurious pressure. The level of the water is regulated by wooden slides. During the greater part of the day the flow of water through the pond is just sufficient to preserve the spawners in health, and to turn the water-wheel; these are the two factors which regulate the quantity. The eggs carried into the collector in this process are, of course, retained; but when the collection for the day is to be made, a large volume of water is poured into the pond, with necessarily a correspondingly large overflow, and the eggs are then collected in abundance. They are lifted out by means of a haircloth tray, the process usually occupying some hours. A slight modification, by the use of large bags of silk bolting-cloth, is being tried. The eggs, when collected, are transferred to the hatching-boxes.

2. The Pumping Apparatus.

As will be seen on the plan (fig. 1), the boiler and pumps are placed midway between the spawning-pond and the harbour. The wooden house in which they are contained is 33 feet in length by 18 feet broad. The floor is concrete and the roof galvanised corrugated iron. It is divided by partitions into three compartments—the coal-house, 9 feet in breadth, and capable of accommodating over 12 tons of coal; the boiler-house, 10 feet in breadth; and the pump-room, 12 feet in breadth. Drain-pipes for waste water communicate with the main waste-pipe from the spawning-pond. In selecting the pumps and motive power, careful inquiries were made as to various systems—gas-engines, oil-engines, pulsometers, &c.; but ultimately it was decided to use steam-power and direct-acting pumps. The boiler chosen was of the locomotive type, made of steel, by Robey & Co., Lincoln, and of 8-horse power. It supplies two direct-acting

and double-acting high-pressure pumps, made by the Worthington Pumping Engine Company. They are specially adapted for pumping sea-water, being brass-lined and fitted with gun-metal valves. There are two double-acting plungers in each pump, which are placed high in the chamber, some inches above the suction-valves, thus allowing subsidence of sand or grit, and diminishing the wear. Each pump is capable of throwing from 2040 gallons to 3900 gallons per hour, according to the speed, and they work with the greatest smoothness and without noise. They have been in almost continuous use since the end of February, without giving the least trouble. The suction or supply-pipes are two in number (fig. 1), one being carried to the harbour entrance, a distance of about 205 feet, and the other to the tidal pond (referred to below), a distance of about 170 feet. They are both made of the best galvanised iron steam-piping, $2\frac{1}{2}$ inches in diameter, and provided with foot-valves and tinned copper strainers. They are not fitted directly to the pumps, but to a central chamber between, which has gun-metal valves so arranged that water may be drawn (1) by either of the pumps, or by both at the same time, from the harbour; (2) by either or by both from the tidal pond; (3) by either from the harbour and the other from the pond; (4) by one pump from both harbour and pond. It was originally intended to draw water from the nearest point in the harbour; but it was deemed better to go to the entrance, where the water is not liable to be contaminated by the refuse from the herring-boats, as may occasionally happen at the parts nearer. From a little below the coping of the harbour quay the terminal portion of this supply-pipe is duplicated, one of the pipes ending below the level of low-water of ordinary tides, and the other being carried much further down, so as to be covered at all tides. Cocks are provided to both pipes, and the water for the hatchery is mainly obtained from the higher level, where it is more free from sand or weed. The delivery-pipe from the pumps is of the same material and diameter as the suction-pipes, and through it water is forced for supplying the spawning-pond and the hatching-house (fig. 2). The distance from the pumps to the point of delivery in the spawning-pond is about 115 feet, and the height to which the water has to be forced is about 25 feet. At a point about 75 feet from the pumps, before the pipe enters the spawning-pond.house, a 2-inch branch pipe of galvanised iron is given off, which runs to the filtering chamber, so that the hatching apparatus may receive a supply direct from the pumps. Cocks regulate the amount which passes either way, namely, to the pond or to the hatchery.

3. The Spawn-Collecting and Filtering Chamber.

This chamber occupies the space between the spawning pond and the hatching house, and is therefore built on the sloping bank (figs. 2, 3). It is 27 feet in length, 12 feet in greatest breadth, and 8 feet in height, and is continuous above with the spawning pond-house. It is built of wood, roofed with galvanised corrugated iron, and has a flooring of cement, up the middle of which runs a wooden stairway; it is suitably lighted. The chamber contains (1) the spawn-collector, which has been already described; (2) the shoot from this to the water-wheel, and the water-wheel; and (3) the filtering apparatus. The filtering apparatus consists of two series of four wooden boxes, one series on either side of the central stairway. The object in having double series is that they may be used alternately to facilitate the cleaning of the filtering cloth. The boxes in each series are placed at successively lower levels, so that the water passes from one to another, and finally to the hatching apparatus. Each box is 4 feet long,

2 feet wide, and 18 inches deep, and is provided with two movable frames (2 feet square), which fit into the top and are covered with filtering material. The delivery pipe from the pumps, previously described, on entering the chamber, divides into two, one for each series of filters. The water falls on the top of the filtering cloth from the arms of a horizontal T pipe, 3 feet long, which is perforated with a series of holes below (fig. 2). Passing through the filter into the box, it escapes from the latter by a similar T pipe going out horizontally near the bottom of the box, and so on successively from box to box. The filtering material of the first box of each series consists usually of cheese-cloth, and the rest of flannel of increasingly fine texture. The pipes from the last box of each series join together, and the pipe is then carried on to the hatching house. Such was the original arrangement of the filtering apparatus. It was, however, found that the boxes, from their size, allowed a considerable quantity of sediment to become deposited in them, especially the upper ones, and in stormy weather; to obviate this being carried on to the next filter, as was largely the case, the outflow from each box was raised from the bottom to near the top, so that the box was kept almost full of water, and facility afforded for the subsidence of suspended matter. The boxes are occasionally cleaned out by means of a hole in the bottom, which is closed by a plug. It was further found that by this method the water was forced with considerable pressure against the flannel, tending to force through the suspended matter, and that the water usually only came in contact with and passed through a limited portion—that, namely, lying under the perforated pipe. Two modifications are being tried. In one the movement of the water in the box is reversed; it enters from a point midway between top and bottom, passes gently upwards through the *whole* surface of the flannel, and overflows into a pipe which enters the second box in like fashion. The frames in this case are wedged against rubber. The other method consists in tying on to the end of the pipe coming from each box a large flannel bag which lies in the box below and is changed from time to time. As may be seen from Mr Dannevig's report, the water during the greater part of the season required comparatively little filtration. But during certain winds, especially from the south-east, the current comes along the coast and enters the harbour by the eastern entrance, passing out by the western end. In such cases a considerable amount of fine matter is carried in suspension in the water, and during its continuance a finer material was used for filtering, with complete success. The water in the spawning pond was also in such cases rendered obscure, so that the fishes at the bottom could scarcely be seen, or not at all. To obviate this on such occasions, the water for the spawning pond will in future pass through a chamber in which most of the suspended matter may settle, and, when necessary, also through a flannel bag. It may here be mentioned that a great variety of crustacea, including copepoda, isopoda, and amphipoda, as well as other small invertebrates, appeared in the pond; the presence of at least the larger forms is of doubtful utility. The filtered water in the hatchery is of course free from them.

The water-wheel is placed in a recess at the side of the hatching house, at the bottom of the chamber, below the end of the shoot coming from the spawn-collector (figs. 2, 3, 4). It is of the overshot variety, 5 feet in diameter, and when doing its ordinary work makes two revolutions a minute, with a supply of from 700 to 800 gallons an hour; the waste water passes into a bricked well, and is thence conveyed by a fireclay pipe to the main drain. The axle passes through the wall of the hatching house, where its movement is made use of in a manner to be shortly described. A large wooden sink for washing the filtering frames

is placed at the bottom of one of the series of filtering boxes; it is supplied by water from the water-wheel shoot (fig. 3). Water from the spawning pond can also be obtained by means of the three pipes passing through the concrete wall, as previously mentioned, and led by canvas hose as required, to the water-wheel or the filtering apparatus.

4. The Hatching House.

This house contains the hatching apparatus, and the incubation of the eggs takes place here (figs. 2, 3, 4). It consists of a substantial and ornamental wooden building, with double walls, 35 feet in length, 24 feet broad, and about 20 feet in height. The woodwork was made in Norway, under the supervision of Captain Dannevig, and erected by local joiners on a foundation of brick and concrete, a space of 3 feet being left between the flooring and the soil for the circulation of air and the convenience of piping. The house is provided with twelve large windows, abundance of light being desirable; four on each side and two on each gable. Between the latter, at either end, a door is placed. The room is capacious, airy, and well lighted, and very suitable for the work. At present sixteen of Dannevig's hatching apparatus have been fitted up. This apparatus, which forms the special feature in the Norwegian method, consists of an oblong wooden box, 8 feet in length, 2 feet 3 inches in breadth, and 1 foot deep. It is divided into two series of seven water-tight compartments, by one central longitudinal and six transverse partitions. The first and the last compartment in each series, those at the ends, are narrow, being 4 inches broad; the inflow and outflow pipes communicate with them respectively. The other five compartments in each series are wider, and it is in these that the hatching-boxes, which contain the eggs, are placed. Each hatching-box is $11\frac{1}{2}$ inches long, $10\frac{3}{4}$ inches broad and $11\frac{1}{2}$ inches deep; the sides are of wood $\frac{5}{8}$ths of an inch thick, and the bottom of haircloth, with meshes fine enough to prevent the escape of eggs, while admitting a free circulation of water. The boxes are attached to the top of the transverse partition by leather hinges, and when the apparatus is full of water, the free end floats up. The apparatus, each with its ten boxes, are arranged in pairs, four on each side of the apartment, and they are placed on trestles, so that the end furthest from the wall is about 3 inches lower than the end next the wall (fig. 4) Two $1\frac{1}{2}$ inch galvanised iron-pipes pass from the 2 inch supply pipe, which enters the room from the filtering chamber, one along either wall. They are provided with sixteen gun-metal cocks, one for each apparatus, by which the quantity of water can be regulated. The water from the cock falls into one of the narrow compartments, which communicates with its fellow, and when both are full it overflows into the first pair of hatching-boxes, and through the haircloth bottom into the compartments in which the boxes are contained; this overflows into the second pair of boxes, and so on until the narrow compartments at the lower end are reached, from which the water escapes by a vertical pipe passing through the floor (figs. 3, 4). The water passes into the top of each hatching-box by a broad metallic spout, fitted into a depression, and it escapes from it through the haircloth bottom. As has been said, the hatching-boxes are hinged at one side; as the compartment becomes full, the free edge of the box is floated up, until it projects about 3 inches above the level of the water. This gives scope for the application of a special feature of Dannevig's method,—the forcible depression of the box at intervals, which forces water up through the haircloth bottom. The current of water passing in by the spout falls on the surface, but it alone is

insufficient to maintain the buoyant eggs, if present in large numbers, in a state of equal distribution throughout the mass of water. The up-and-down movement imparted to the boxes is accomplished as follows:—A galvanised iron rod, 7 feet 3 inches long, is jointed to the middle of the upper end of the hatching apparatus, and passes down the centre between the series of boxes. It possesses five short, transverse pieces, one resting on the free edges of each pair of boxes, and it is weighted sufficiently to keep the boxes depressed and submerged in the water. When the rod is raised, the buoyancy of the boxes causes them to float up, as has been described. The movement of the rod is brought about by the use of an excentric wheel or cam, which revolves about twice in a minute, and is driven by a strap from a wheel placed on the axle of the water-wheel, which, as has been seen, projects into the room at one corner (fig. 3). Resting on the cam is one end of a wooden beam, about 15 feet in length, which moves on a hinge. The beam rises and falls on the cam, and this motion is conveyed to the galvanised rods by a system of wires, cranks, and pulleys, so that they are slowly lifted from the boxes and allowed rather suddenly to fall upon them, and press them into the water, which rises through the perforated bottom. By this means the floating eggs are kept equably distributed, as may be demonstrated by a dip-tube passed down to the bottom of the box. If the movement is stopped, the eggs collect in a layer on the surface. The other end of the poised beam is weighted, so that the amount of work to be performed by the water-wheel in lifting the iron rods is very small. The speed of the wheel can be simply regulated. After a season's experience at Dunbar it may be said that Dannevig's system is simple and efficient, and requires comparatively little attention.

The fish eggs obtained from the collector, as before described, are placed in the boxes, and a constant current of water maintained through them. Dead eggs are easily recognisable, and are removed from time to time.

5. The Tidal Pond.

It has been stated that one of the principal reasons which determined the selection of the site for the Hatchery was the presence of convenient sea-creeks adjoining, the use of which had been granted for fishery work (fig 1). These creeks, if inclosed, would provide a volume of pure sea-water amounting to a little over half a million gallons, and would furnish an admirable inclosure for rearing the fry, preserving large numbers of spawners, and for carrying on other important work. The Board have not yet been in a position to deal with these creeks; but for temporary purposes, a small arm or inlet of one of them, which passes in under the ruins of the old castle, has been utilised (figs. 1, 5). This sub-creek formed, indeed, a cave, roofed with a lofty natural arch of rock, closed towards the east by the massive masonry of the harbour and by a stone wall, and opening westwards by a narrow mouth, through which the sea from the creeks flowed and ebbed. It formed part of the ancient dungeon of the castle. The entrance, which is about 10 feet wide, was closed by a strong wall of concrete, 13 feet high and 8 feet thick for 3 feet up from the base, tapering thence to a thickness of 3 feet at the top, the inside surface being vertical, and covered with a layer of fine concrete 6 inches thick. Two 6-inch iron pipes, provided at the inner ends with suitable gun-metal valves, are carried through the wall—one at the base, for the purpose of emptying the pond, and the other at a height of 5 feet, for the admission of water (see fig. 1, p. 207). The valve of the lower or flushing-pipe is of the sliding type, worked from above by an iron rod, while the upper pipe is provided with a flap-valve, placed

at an angle with the axis of the pipe. This valve works automatically, opening with the flowing tide and closing on the ebb, so as to retain the water which has been admitted. Suitable gratings are fixed to the outer ends of the pipes. In order to enlarge the area inclosed, a considerable quantity of rock was quarried from the bottom and partly from one side. The top of the concrete wall came to within about 3 feet of the upper limit of the arched entrance, this space being left open. But it was found necessary to close this gap, since in storms sea-weed was carried over the wall, sometimes in considerable quantities. It was also found that, notwithstanding the presence of a fine wire-grating on the outer end of the inflow pipe, sea-weed was battered through in a comminuted form by the force of the waves, and accumulated on the bottom of the pond. To obviate this, a strong wooden box was made, 10 feet long, 2 feet wide, and 18 inches deep, which was bolted erect to the inside of the concrete wall, and into which all the water coming in by the pipes entered. It was made water-tight, and was fitted with two filtering-frames, on indiarubber jointing, through which the inflowing water passed, and with a door similarly jointed opposite the outflow below. Cheese-cloth was found to be an efficient filtering material. This arrangement has given complete control of the water, and has been found to work well. In stormy weather, the water entering can be passed through any suitable filtering material and rendered limpid. As has been said, the apparatus works automatically; when the tide rises outside above the level of the upper valve and of the water inside, the valve is forced open (and the extent of the opening can be regulated), and water pours into the filtering-box, and thence into the pond. When the tide ebbs and the level of the sea outside falls below the level of the water inside, the valve closes and the water is retained. The floor of the pond has been covered with a layer of concrete, and a doorway made through the eastern wall, which opens to the harbour quay. Light is admitted by natural apertures and by the glass panels of the doorway. A gangway passes from the masonry of the quay to the concrete wall, and gives access to the filtering-box and valves.

The tidal pond thus constructed is about 42 feet in length; the breadth varies, but may, on an average, be taken at about 20 feet, and the depth of water at high tides is about 9 feet or more. It is capable of containing about 7560 cubic feet, or 47,000 gallons of water. One of the suction-pipes from the pumps is carried into this pond, from which filtered water may be drawn in stormy weather, when the tides are low, or as desired. It also serves as a small storage pond for the spawners to be used in the hatchery, and is very serviceable in this respect, but not of sufficient size to accommodate all the fishes required.

6. The Work at the Hatchery.

The hatchery at Dunbar has been established for the purpose of enabling many millions of the young of the valuable food-fishes to be placed on the fishing grounds each year. At the similar institutions in the United States, Norway, Canada, and Newfoundland, the species of food-fish which has been almost exclusively dealt with is the cod, which forms a very important element in the fisheries of those countries. Experiments on a comparatively small scale were also made by Dannevig in hatching the eggs of the flounder and common dab, and by the U.S. Fish Commission with the winter sole (*P. americanus*). In this country the cod, while a most important factor in the fish supply, is not the most valuable, and there is no very definite evidence that it is diminishing in

numbers. On the other hand, there is clear evidence that the valuable flat-fishes, such as turbot, soles, lemon soles, and plaice, are becoming much more scarce than they were even a few years ago—especially on inshore grounds, and in comparison with the increase in the machinery of capture. This has been shown in previous Reports of the Fishery Board, in various statistics published by the Board of Trade, and by the enquiry made by the Parliamentary Committee on Sea Fisheries last year. It was therefore decided to begin the work at Dunbar by hatching those flat-fishes in as large numbers as possible,—namely, turbot, soles, plaice, and lemon soles.

The Plaice (*Pleuronectes platessa*).

The plaice, which is the earliest of the flat-fishes to spawn, was the first dealt with; but, as the hatchery was not sufficiently completed to allow operations to be begun until early in March, full advantage could not be taken of the spawning of this species. The spawning season of the plaice extends from about the middle, or even the early part, of January until the end of April or beginning of May. In December and February a number of living plaice were obtained by the 'Garland,' and put into the tidal pond. Stormy weather, however, interfered with this source of supply, the 'Garland' being then unable to trawl offshore; and it was found necessary to send the mate of the 'Garland' on board one of the local trawlers, provided with large tubs through which a constant circulation was maintained, and in which the most suitable specimens might be preserved. From the comparatively small size of the tidal pond, and the lateness of the season, it was necessary to transfer the fish, on landing, at once to the spawning pond, a procedure open to several objections. Even with so hardy a form as the plaice, a considerable proportion are injured in the process of capture, especially when, as in this instance, they are heavy and bulged with spawn. Such injured specimens are not always easily detected, and they mostly die subsequently and cause trouble. They tend to taint the water, and may even inhibit the spawning of the healthy fishes confined with them in the pond. The proper course is for the individuals intended to be used as spawners, to be first of all kept in the tidal pond, or similar enclosure, until those that have been injured have been weeded out, and only the healthy vigorous fishes which have become accustomed to confinement, transferred to the spawning pond. This implies gradual collection of the fishes before the spawning season; and the best spawners should be kept from year to year. None of the fifty-eight plaice, which had been put into the tidal-pond in December and February and transferred to the spawning pond in March, succumbed during the season. The greatest number of adult plaice in the pond at one time was about 390; but it might well have held between 500 and 600. In regard to the proportion of the sexes, the males were in rather less numbers, relatively to the females, than obtains in the sea; but almost all the eggs examined were found to be fertilised. It is probable that, from the comparative quietude and the limited volume of the water, a smaller proportion of males than naturally exists will be sufficient to ensure impregnation of the eggs, and thus the functional capacity of the pond may be considerably increased.

The number of eggs of the plaice, collected from the spawning pond between March 9th and May 8th, was 27,250,000, and the number of fry hatched and placed on the fishing grounds was 26,060,000 (see p. 215). The percentage of loss was therefore very low, amounting to no more than 4·4 per cent. Had it been possible to begin the work early enough to include the whole of the spawning period of the plaice, and to stock the

pond to its full extent, three or four times the number of plaice eggs might have been obtained.

The Sole (Solea vulgaris).

This very valuable fish is extremely scarce in Scottish waters; the number obtained by the 'Garland' in the course of a year might be counted on the fingers. In order to obtain a supply for the hatchery, the 'Garland' proceeded last summer to the Yorkshire coast, and carried on trawling there, with the permission of the Committee of the North-Eastern Sea Fisheries District.* The soles were preserved alive in tubs, but a considerable mortality occurred, although the utmost precautions were taken. Most of them were placed at selected spots in St Andrews Bay, and as many as it was judged the tidal pond would contain were put into it. But many of them died subsequently, and on examination were found to possess patches of congestion on the lower surface or the fins, where the skin had been abraded. The pond at this time was not completed, and the difficulties from ingress of sea-weed, and from other causes, were considerable. The soles were removed to allow the bottom of the pond to be concreted, and, sometime after they were replaced, numbers succumbed, apparently by the action of the concrete before it had hardened. But when the difficulties referred to were overcome, the remainder were preserved throughout the winter in perfect health. It was necessary, however, to increase their number before beginning operations, and as this fish is very scarce on the east coast of Scotland, and enquiries elicited the fact that the 'Garland' would be unable to procure them in the spring off the English coast, it was arranged, through the instrumentality of Mr Alward of Grimsby, and Mr Holt, to send Mr Liston with tubs on board a large North Sea trawler, the 'Tynecastle.' This vessel was fishing from 29th April to 5th May off the coast of Holland, and a large number of soles were caught, but it was found impossible to preserve them alive. Out of several hundreds which had been tried in the tubs only twelve were living when the English coast was sighted, and these perished before they could be landed. They all seemed to have been too much injured in the trawl, which was dragged for six or seven hours. Mr Liston came to the conclusion that this method would not succeed. At this stage the Lancashire Sea Fisheries Committee, through Mr John Fell, the Chairman, and the Superintendent, Mr Dawson, kindly agreed to allow their steamer, the 'John Fell,' to trawl for soles off the Lancashire coast, specially for the use of the hatchery. In this case the trawl was dragged only for short periods, the soles were vigorous when brought to deck, and Mr Liston had no difficulty in preserving them alive while on board. In order to transport them from Fleetwood to Dunbar by rail, three galvanised iron tanks, with compartments for ice, lent for the purpose by Mr Anderson, fishmonger, were used. These tanks were 3 feet long, 20 inches broad, and 16 inches in depth. The railway journey, *viâ* Carlisle and Edinburgh occupies about ten hours. Three journeys were made. On the first, fifty soles were place in the boxes; on arrival at Dunbar only six were alive (and they died in a few hours), and the water was full of slime. On examination of the dead fishes it was found that their surfaces were much rubbed and the scales removed. The lids fitted loosely, allowing the water to jolt and splash about, and it was evident the soles had succumbed

* The work of the 'Garland' was guided and assisted by the efforts of Mr John Woodall of Scarborough, who sent his yacht 'Valotta' to aid in the work; and by Mr Ernest W. L. Holt, of the Marine Biological Association, who has on various occasions courteously given information and assistance.

chiefly by friction against the bottom and against one another from the movement of the train. After some experiments on the behaviour of particles in vessels containing water and a little air, and in vessels containing water and devoid of air, when shaken about, it was found that the most suitable mode was to exclude air altogether, and to bring the fish in—so to speak—a block of water in which wave-motion could not occur. The iron boxes were accordingly so arranged as to be kept during the journey, absolutely full of water, by means of water-tight lids. Wooden boxes were also made, furnished with lids fitting on a depressed fillet, covered with indiarubber strips, so as to be quite water-tight, and provided with ice-tins. This plan succeeded well. On the second journey forty soles were brought, and they were all alive, save one, on reaching Dunbar, and the water was clear; but five died later. The temperature during the journey was kept at or somewhat below the original temperature of the sea-water in which they were contained. On the third journey forty-two of forty-seven were brought in good condition. Air was at intervals blown into the boxes through tubes, by means of bellows. The soles thus obtained were at first placed in the tidal pond. When sole eggs (unfertilised) were observed in the water the fish were transferred to the spawning pond; a special arrangement, described below, having been adopted in order to allow turbot at the same time to be contained in the pond. The experience with the sole shows that it is a fish very easily injured, and requires careful handling and treatment. Those to be used as spawners in hatching operations should be collected sometime before the spawning season.

The Turbot (*Rhombus maximus*).

The difficulties in procuring a supply of living turbot were also great. One of the staff was on board an Aberdeen steam-trawler for a few weeks for the purpose, but, owing to bad weather and other causes, comparatively few were caught, and it was found impossible to keep them alive. The local fishery officer (Mr John Murray) succeeded, on board a Granton trawler, in procuring several specimens, some of which were, however, a little injured and died later. The best mode was found to be to get the fish on the Ayrshire coast, where they are caught, not by the trawl, but in set-nets, and are not so much injured. Adopting the same method as in the transport of soles, seven were brought on one journey, twelve on another, and twenty-one on a third, making forty in all, of which seven died. The number of turbot now in the spawning-pond is thirty-eight, of which about 20 are females and the rest males.

The modifications, above referred to, made in the spawning-pond in order to adapt it for containing spawning soles and turbot at the same time, are as follows:—The wooden floor has been raised to a height of three feet from the concrete bottom, about 8 feet of water being therefore above it. The pond has been divided into two compartments by a transverse partition of stout waterproof canvas, extending from about six inches above the level of the water to nearly the concrete bottom, and carried, therefore, more than two feet below the wooden flooring on which the fishes rest. At the sides the canvas is wedged firmly and accurately against the concrete wall, the only communication between the two compartments being close to the concrete bottom. Each compartment is supplied with a separate inflow pipe, and a wooden shoot, provided with suitable water-tight sliding pieces, is carried from the second compartment to the fixed spawn-shoot (p. 198). By this means the overflow can be taken from either compartment as desired, and the collection of eggs made alternately, by using only the inflow and outflow of the particular compart-

ment. The possibility of the floating eggs from one compartment finding their way against the current, down through the flooring, for a distance of nearly 3 feet, to the concrete bottom, and up into the next compartment, is exceedingly remote. At all events, from the dissimilarity of the eggs of the sole and turbot, such an occurrence, should it take place, can easily be detected by subsequent examination of the eggs collected; and, from the practical point of view, it would be of little importance so long as the period of incubation approximately corresponds in the two cases, and the fry are to be placed on the same grounds. Sperms, no doubt, might occasionally pass, by their own movement, from one compartment to the other by the route indicated; but there is little apprehension on this account, as it is pretty certain, from the observations made with the plaice, that the eggs are impregnated by the attendant male at the moment of their ejection.

The Lemon Sole (Pleuronectes microcephalus).

This is one of the most valuable of the flat-fishes in Scottish waters. The spawning season extends from the end of April or beginning of May to the beginning of September; the spawning is greatest in July. While the 'Garland' was carrying on her ordinary trawling work, such specimens were preserved alive as seemed suitable for hatching purposes, and as many of these as could be accommodated were placed in the tidal pond. It was decided to collect the eggs of this fish in the tidal pond, and for this purpose the following arrangement has been made (fig. 1):—The filtering frames have been removed from the filter-box (F), into which all the inflow water passes, and the openings closed up. The water passes from the box into the pond through two 5-inch flexible pipes,

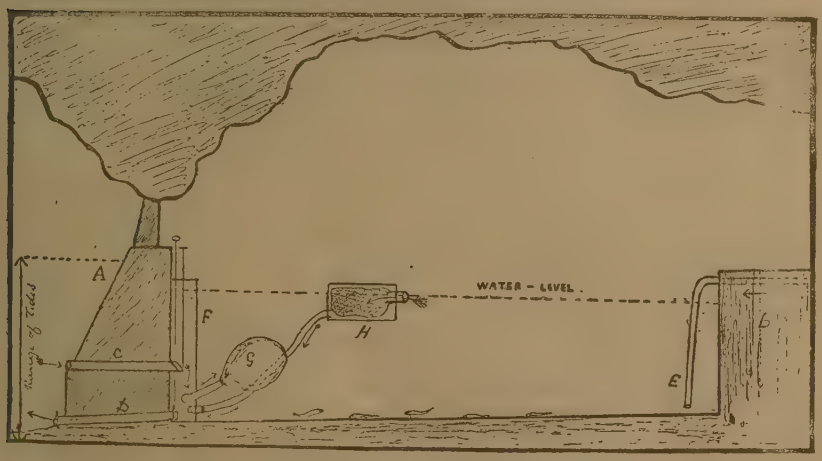


Fig 1.—Longitudinal Section through the Tidal Pond. A Concrete Wall, B, masonry of harbour, C inflow, and D, outflow pipes; E, supply pipe to pumps; F, filter-box; G, filter-bag; H, floating spawn-collector.

to which filtering-bags may be attached as desired (G). The outflow water is carried from the pond by a 5-inch flexible canvas pipe, 8 feet long, opening into one end of a large wooden box (H), floating on the surface of the water in the pond, and communicating with the filter-box. The outflow water enters this floating-box by a short 5-inch pipe, to the

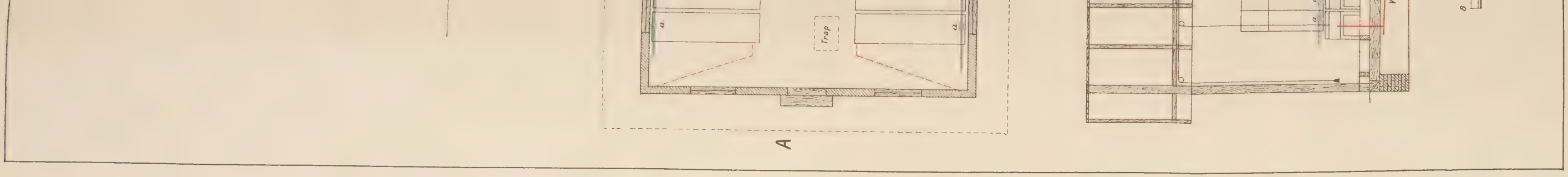
inner end of which a large bag of silk bolting-cloth is attached, and the buoyancy of the box is so modified as to keep this pipe almost submerged beneath the surface. By this means a *floating* spawn-collector is provided. The fishes spawn freely in the pond, and as all the water leaving the pond must pass through the large bag of silk netting, the floating eggs are retained in it; the rapidity of outflow can easily be regulated by the valve. The device of collecting the eggs by a floating collector is due to the ingenuity of Mr Harald Dannevig.

7. The Treatment of the Fry.

With the present arrangements it is necessary to transfer the fry directly from the apparatus in which they are hatched, to the fishing grounds where they are to be placed, without the intervention of a period in rearing ponds. The larval fishes, after emerging from the eggs, are retained in the hatching-boxes until the yolk is nearly absorbed, and they are capable of eating; but without large inclosures, such as exist in pisciculture establishments for fresh-water fishes, no attempt can be made to feed them. They are, therefore, placed in the sea while they are still in the larval stage. At this period, it need scarcely be said, the fry of flat-fishes resemble those of round fishes, such as cod or haddock. The eyes are placed one on either side of the head, and the body is symmetrical. The characteristic appearance of a flat-fish is absent. It is only after an interval of two months or so, which are passed in the surface waters, that this flattening is completed, and the young creature acquires the form and habits of the adult and becomes fitted for life on the bottom. There can be no question that the destruction of the young from natural causes during this period of pelagic life is very great; and that a great step in advance would be made if it were possible to protect them artificially until they were about to complete the transformation which adapts them for a bottom life, and enables them to secure natural protection by resemblance to the ground on which they lie, and by burrowing. They are still at this stage very small, and multitudes could readily be dealt with. For the purpose of thus dealing with them it is necessary to have control of a large body of water, such as is shown in the sea-creeks on the plan (Pl. I. fig. 1), in which many millions of fry could be simultaneously reared for the necessary period before planting them on the fishing grounds. The supply of food naturally existing in such a volume of sea-water could be largely increased by keeping various invertebrates, at the time when they are spawning, in the tanks shown at A on the plan (Pl. I. fig. 1). A reference to the plan will show that a flow of water from the spawning pond could be maintained through these tanks into the creeks, which would thus receive a constant supply of water, charged with embryos and minute organisms, upon which the young fishes live. The rearing of the young fishes in this way for a few weeks would very greatly increase the usefulness of the hatchery to the fishing industry.

8. The Capacity of the Hatchery.

The present hatching-house contains, as has been stated, sixteen of Dannevig's hatching apparatus, each of them capable of accommodating at one time about five million cod eggs, or 80,000,000 altogether. Since, during the continuance of the spawning season of any species, the hatching-boxes may be refilled at least twice—newly collected eggs replacing the fry which have been hatched and removed—the capacity of the present hatch-



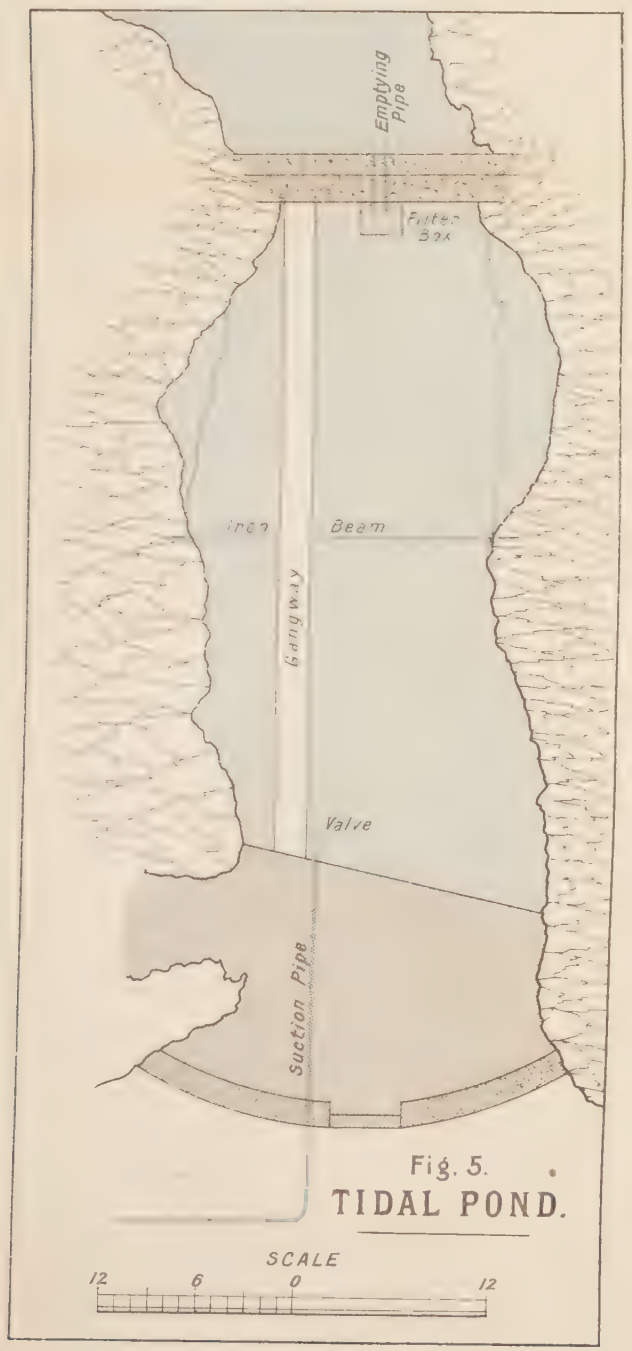


Fig. 5.
TIDAL POND.

GENERAL PLAN

SHOWING ARRANGEMENT OF

PIPES AND SEA CREEKS.

Fig. 1.

Alex. D. Melville
Dunbar.

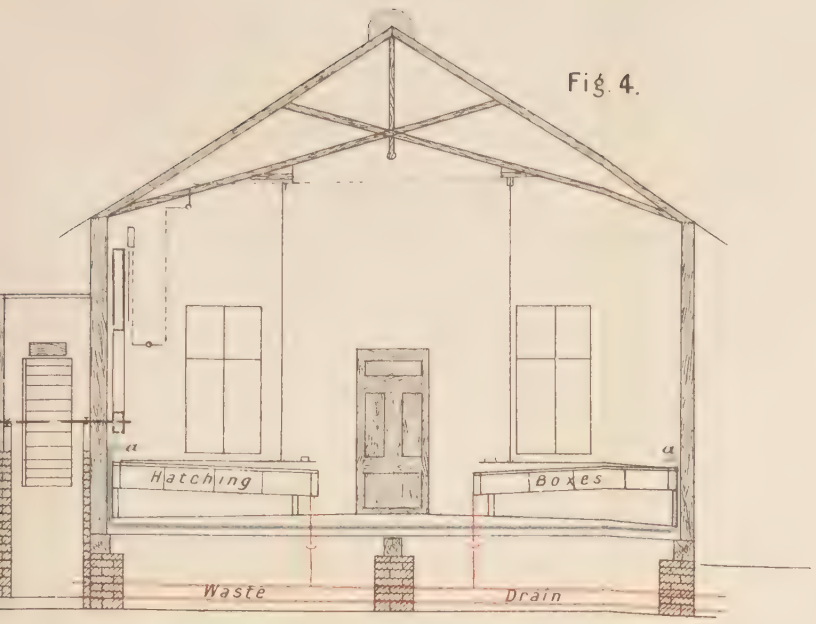


Fig. 4.

Section through C.D.

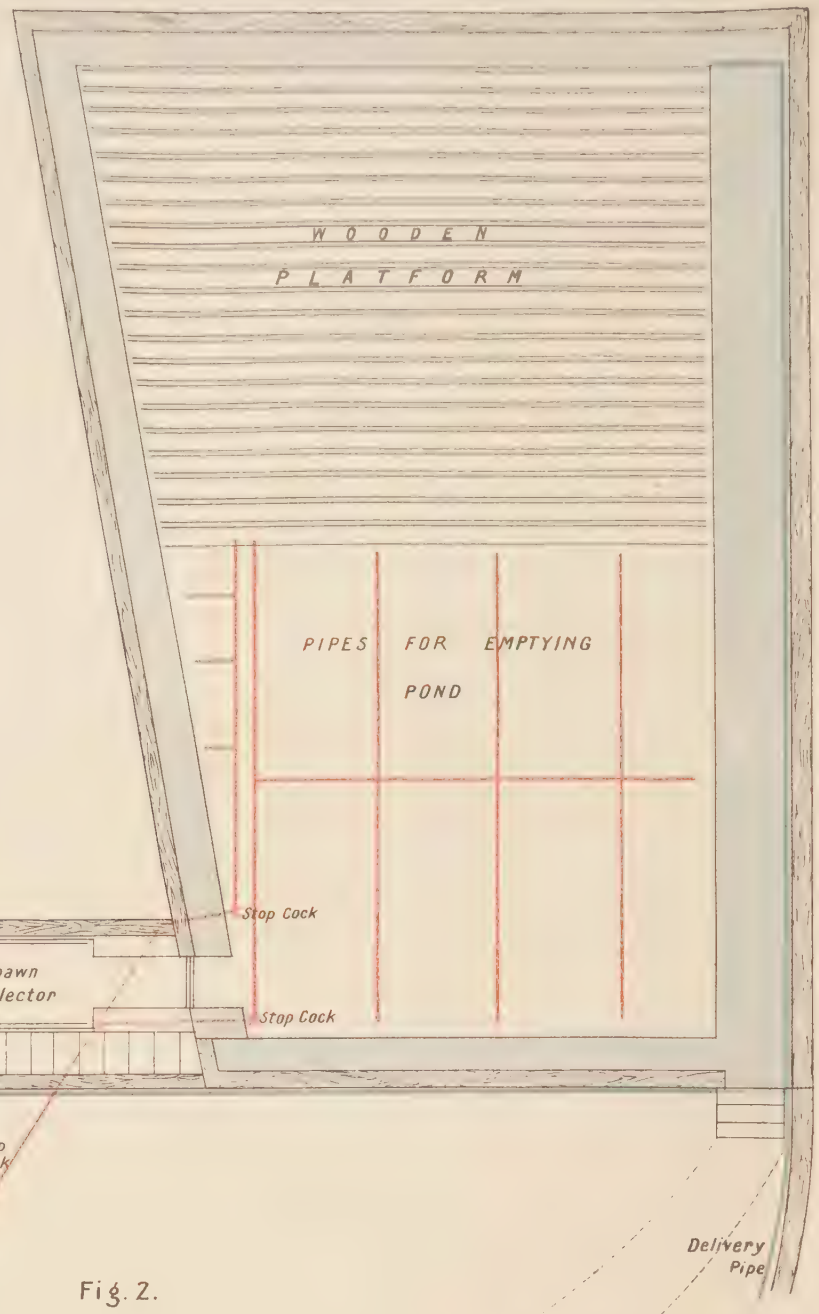


Fig. 2.

Plan.

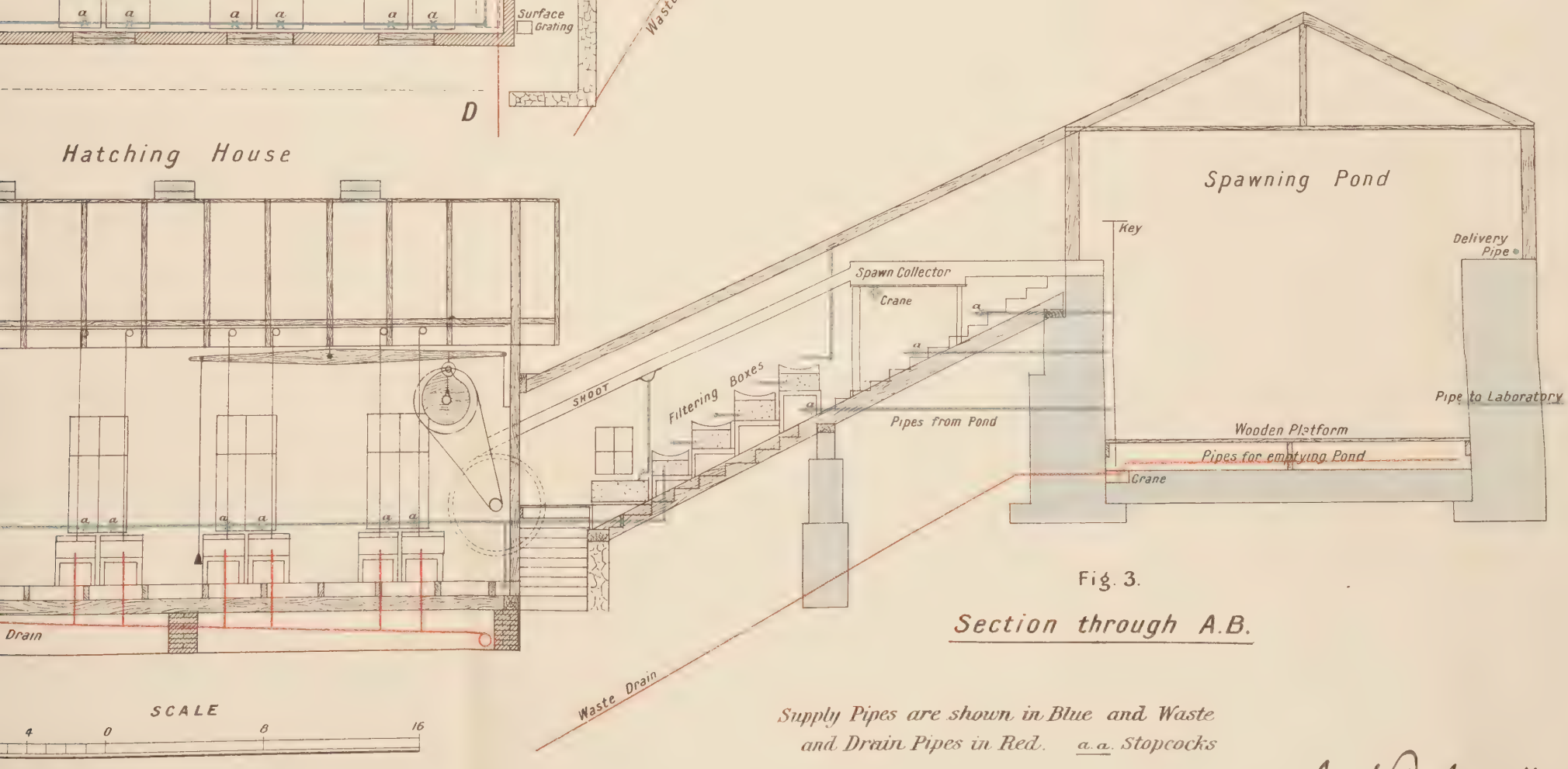


Fig. 3.

Section through A.B.

SCALE

4 0 8 16

Supply Pipes are shown in Blue and Waste and Drain Pipes in Red. a.a. *Stopcocks*

Alex. D. Melville

Dunbar.

ing apparatus may be stated as equal to about 160,000,000 cod eggs during one season. Plaice eggs are larger than those of the cod (about 1·6 mm. compared with 1·2 mm.), and a smaller number go to a box, but the number that might be dealt with in the course of the season may be stated at about 100,000,000. The eggs of the sole are about the same size as those of the cod, and those of the lemon sole and turbot slightly smaller, so that the working capacity of the present apparatus in the course of a year may be put down at several hundred millions. Further, in arranging for the more costly parts of the hatchery, care was taken to provide for sufficient water supply and spawning space for a much larger number of hatching apparatus. Dannevig's experience at Flödevig is that about 92 gallons of water are required per hour for each apparatus, that is, for about five million cod eggs. For sixteen apparatus the supply therefore requires to be about 1500 gallons per hour, and, adding 800 gallons for the spawning pond, the total quantity for 80,000,000 cod eggs is about 2,300 gallons per hour. The pumps are, however, capable of throwing over 7000 gallons per hour, and thus the quantity of spawn that may be dealt with may be more than doubled by a comparatively inexpensive extension of the hatching-house and increase in the number of apparatus.

The first year's work so far has been satisfactory. The boiler, pumps, water-wheel, and all the apparatus have been in continuous use without any hitch occurring; and the filtration of the water was accomplished without much trouble, and it has proved eminently suitable for hatching work. The greatest difficulty, as has been said, was in procuring supplies of spawners in time to take full advantage of the spawning season. At the sea-fish hatcheries in the United States, Norway, and Newfoundland, ample accommodation has been provided for large numbers of spawners—at Woods Holl, for instance, as many as 3000 adult cod have been accommodated at one time. Thus, by obtaining, before the spawning season begins, the full number of adult fishes required to keep the hatchery going at its full working capacity, the number of fry produced may be very largely increased, and at a trifling additional expense, since it costs almost as much to produce fifty millions as it does to produce two hundred millions.

IV.—ON THE HATCHING OPERATIONS AT DUNBAR MARINE HATCHERY during the Spring-Season, 1894. By HARALD DANNEVIG, of the Marine Hatchery, Flödevig.

In the following pages I have the honour to give in detail an account of the hatching operations during the past season at the Dunbar Marine Hatchery, which were carried on under my supervision. The hatchery has been constructed as far as possible after the model of the one at Flödevigen, in Norway, and the same system, invented by my father, and now for several years employed there, has been adopted at Dunbar.

Hitherto hatching operations on a large scale have only been carried on with the eggs of cod, and it was somewhat difficult to say beforehand what might be the results with plaice, and especially how the spawners should be dealt with. Before the hatchery was ready a number of spawners had been collected by the 'Garland' and placed in the tidal pond, and others were obtained from trawlers during March and the early part of April, and transferred directly to the spawning pond. As March is considered to be the middle of the spawning season for plaice, some of the fishes put into the pond had already cast part of their spawn. On the other hand, others had been injured in the trawl-net, especially the females, which are more readily hurt when full of roe; and a number of these died. The hatching operations may be described as follows:—

I. THE SPAWNERS IN THE POND.

The fitting up of the hatchery having been completed at the end of February, 58 plaice were transferred from the tidal pond to the spawning pond on the 3rd of March. Except five specimens caught by the 'Garland' late in February, all these had been confined in the tidal pond from the 6th December 1893, where they had been regularly fed. Other 34 plaice were put in on March 8th. On the 14th the water was lowered, and on examination most of the fishes were found to be in good order; a few which had been injured during the trawling were not so well. The same day 49 newly caught fishes were put into the pond, some of which had also been injured. Of the latter I found some dead on the 16th.

Later on, the following numbers of plaice were put into the pond on the dates mentioned:—March 15th, 80; March 28th, 70; April 3rd and 4th, 89; April 10th, 16; making the total number of plaice put into the spawning pond 396.

Of 391 specimens which were measured, the sizes varied from $13\frac{1}{2}$ to $28\frac{1}{4}$ inches, as follows:—

TABLE I. *Showing the number of fishes and the different sizes.*

[1] Length in inches .	14	15	16	17	18	19	20	21	22	23	24	25	26	27	$28\frac{1}{4}$	Aver. length, $19\frac{4}{16}$ ins.
Number of fishes .	7	34	41	58	60	33	39	32	23	20	26	11	4	2	1	Total number, 391.

[1] Part or parts of an inch are transferred to the nearest whole figure.

Amongst the fishes brought on the 15th of March and earlier, a number were found whose sex was not easily ascertained; they were all under 18

inches in length, and were put down as unripe males or immature females. In the following table is shown the average difference in length between the sexes. The fishes used for the comparison were caught at the same time and on the same ground, and were brought on the 14th of March or later.

TABLE II.' *Showing the average sizes of Males and Females.*

[1] Length in inches .	13½	14	15	16	17	18	19	20	21	21½	22	23	24	25	26	27	28½	Aver. length.
Males . . .	3	3	11	12	23	17	7	12	2	2	..	..	..	..	..	..	..	17⅜
Females . .	..	1	1	4	13	21	13	21	18	..	15	15	22	10	3	2	1	20⅞

[1] Part or parts of an inch are transferred to the nearest whole figure.

The number of males put into the pond in proportion to females was about = 4 : 7.

When fish are caught by trawling in the ordinary way, a number of them are more or less injured by pressure and rubbing, and are not always suitable for confinement. The injured fishes will generally die. Besides, the spawners used for the hatchery were mostly caught during the spawning season, when they are more liable to injury than at any other period, so it was likely a larger number would succumb than if they had been caught at any other time of the year. I had occasion to observe that, if the fish was not killed by the wounds themselves, the injuries caused the females to abstain from regularly spawning.

I always found the fishes that were not injured in a satisfactory condition, and a quantity of lugworms was devoured by them daily. The vigorous state of those accustomed to confinement, when transferred from the tidal pond to the spawning pond, and the fact also that the great number of those taken directly from the sea were feeding so well, show that the arrangements and the pond itself are well qualified to keep fishes alive when they are put sound and healthy into it.

In order to decrease the effect of confinement, especially regarding the injured fishes, the windows above the pond were all blackened, so that only a very dull light passed into the room. The effect of this arrangement was surprising. While the greater number of the fishes used previously to crowd together during the day in the darkest corner—one above the other—they now moved freely along the bottom all over the pond. During the days following the change I collected more ova than on the days before; and, on a dull day, I even saw the fishes spawning during the afternoon. When confined in an open pond the fishes only spawn during the night. I soon found that the wooden flooring caused no harm to the fishes; but, for the sake of those injured, I put down some gravel in one corner, by which the spaces between the boards in the flooring were covered, and above the gravel I put a layer of fine sand. From this time onwards this corner was the favourite spot where the fishes congregated.

THE HATCHING OPERATIONS.

The ova having been shed and fertilised in the pond, and remaining suspended in the water, are gathered together in the so-called 'collector.' From this the spawn is transferred into the hatchery, and, after being

'cleaned' and the quantity measured, is put into the hatching boxes, where the further development takes place.*

In measuring, the following process is used:—A small glass vessel is filled with ova without any water, and the volume of the vessel being known, a calculation can easily be made of the number of ova it contains. The following observations form the basis on which the computation of the number of plaice eggs for the season was made. 50 c.c. of eggs were counted three times with the following results:—

1st counting, 11,734 eggs.
2nd ,, 11,730 ,,
3rd ,, 11,738 ,,

Average number = 11,734 in 50 c.c. = 234,680 ova per 1000 c.c. = 1 litre.

In 40 c.c. I counted 9,425 ova = 235,625 ova per 1000 c.c. = 1 litre.

As the basis for the computation of the eggs in the hatchery, I used the ratio of 230,000 eggs per litre, so as to be under rather than over the mark. The first eggs were collected on the 9th of March, and collections were made almost every day till the 8th of May. During that time 27,250,000 ggs were put into the hatching boxes, and 26,060,000 fry were transferred to the waters of the Firth of Forth and St Andrews Bay by the 'Garland.' In the following table (p. 213) the daily progress of he work is shown.

It will be seen that the proportion of the eggs which succumbed in the hatching apparatus was very low, about 4·4 per cent. for the whole season, which is surely the best result ever obtained in hatching of buoyant fish ova, and carried out on a large scale. Nearly all the ova collected were fertilised; the percentage of those not fertile would, in reference to observations made, not exceed 0·1 per cent., included in the above figure. When any unfertilised eggs were observed, it was always after some interference, such as the lowering of the water, which caused the fishes generally to abstain from spawning for a day or two. Being among the largest of the pelagic forms, the plaice ova are strong, and more capable of resistance than, for instance, in the case of those of the cod. Half a million of cod eggs fertilised on board a trawler were placed in separate boxes, and hatched without much loss.

In reference to Table III., the figures referring to the number of eggs found dead in the boxes require some explanation. The first figure is put down on March 18, when 30,000 were taken out of the boxes. Of course those ova did not die all on that day—the figure shows how many had died since the beginning of operations on March 9. But for convenience of the method of working, it is put down under the date on which the boxes are examined and the dead ova taken out. The same is the case with the rest of the figures referring to them. The amount of the figure on a given date depends also upon how many boxes were examined on that date, and how many days had passed since the last examination of the special boxes.

The temperature of the sea-water at the beginning of the work was about 4·5° C.; after that it rose gradually to 8·8°, or nearly 9° C., when the operations with the plaice was at an end in May. The influence of the temperature on the hatching time will be seen from the following observations:—The eggs first collected were hatched in twenty-one days, while the average temperature was 5·24° C.; those last collected hatched in fourteen days when the average temperature of the water was 8·86° C.

* The 'cleaning' process consists mainly in the addition of fresh water sufficient to lower the specific gravity of the sea-water in which the eggs are floating until these sink. The upper layer, containing any extraneous matter, is then poured off.

TABLE III.—SHOWING THE DAILY PROCEEDINGS AT THE HATCHERY, AND OBSERVATIONS ON TEMPERATURES, SPECIFIC GRAVITY, AND TRANSPARENCY OF THE WATER.

Date.	Number of Eggs Collected.	Number of Eggs Found Dead in the Boxes.	Number of Fry Put Out.	Total Number in Boxes.	Temperature of the Air at Noon.	Temperature of the Water at 9 A.M.	Specific Gravity of the Water at 9 A.M.	Transparency of Water at Noon, in Feet.	Direction of Wind, &c.
Mar. 9	225,000	..	..	225,000	..	4·5	1027·1	...	Where nothing else is noted, the wind was off shore; the observations on the transparency were carried out between 11 and 1 o'clock, when the sky happened to be clear. In other cases is noted "dull."
,, 10	115,000	..	..	340,000	..	4·4	1027·2		
,, 11	..	..	..	340,000	..	4·6	1027·2		
,, 12	..	..	..	340,000	..	4·5	1027·0		
,, 13	270,000	..	..	610,000	..	4·6	1027·0		
,, 14	130,000	..	..	740,000	..	4·8	1027·0		
,, 15	190,000	..	..	930,000	..	4·9	1027·0		
,, 16	120,000	..	..	1,050,000	..	5·2	1027·3		
,, 17	..	..	..	1,050,000	..	5·5	1027·1		
,, 18	300,000	30,000	..	1,320,000	..	5·4	1026·8		
,, 19	450,000	..	..	1,770,000	..	5·6	1026·7		
,, 20	525,000	..	..	2,295,000	..	5·7	1026·4		
,, 21	450,000	40,000	..	2,705,000	..	5·6	1026·7		
,, 22	530,000	..	..	3,235,000	..	5·8	1027·0		
,, 23	500,000	..	..	3,735,000	..	5·9	1027·0		
,, 24	450,000	..	..	4,185,000	..	5·8	1027·0		
,, 25	..	..	..	4,185,000	8·9	5·8	1027·0		
,, 26	950,000	60,000	..	5,075,000	10·0	5·6	1027·2		
,, 27	600,000	..	..	5,675,000	11·7	5·2	1027·2		
,, 28	..	..	..	5,675,000	11·1	5·4	1027·3		
,, 29	900,000	75,000	325,000	6,175,000	12·2	5·6	1027·0		
,, 30	880,000	..	..	7,055,000	14·5	5·9	1027·0		
,, 31	750,000	..	..	7,805,000	13·4	6·0	1027·0		
April 1	..	..	..	7,805,000	12·8	6·4	1027·2		
,, 2	1,130,000	80,000	..	8,855,000	7·3	6·4	1027·1		
,, 3	680,000	..	..	9,535,000	7·8	6·3	1027·2		
,, 4	670,000	..	..	10,205,000	8·4	6·4	1027·1		
,, 5	627,000	30,000	..	10,800,000	6·1	6·1	1027·2		
,, 6	750,000	..	..	11,550,000	5·0	6·2	1027·1		
,, 7	600,000	..	..	12,150,000	3·9	6·2	1027·2		
,, 8	650,000	..	..	12,800,000	4·5	6·1	1027·1		
,, 9	530,000	110,000	..	13,220,000	13·9	6·0	1027·2		
,, 10	..	..	..	13,220,000	13·4	6·6	1027·1		
,, 11	600,000	35,000	1,875,000	11,910,000	15·0	6·9	1027·2		
,, 12	750,000	..	..	12,660,000	12·8	6·7	1027·2		
,, 13	690,000	..	..	13,350,000	10·0	6·9	1027·1		
,, 14	1,275,000	30,000	2,000,000	12,595,000	10·0	7·0	1027·0		
,, 15	520,000	..	..	13,115,000	8·9	7·0	1027·2	18	S.E.
,, 16	750,000	..	..	13,865,000	9·5	7·0	1027·1	8	S.E.
,, 17	651,000	..	..	14,515,000	8·9	7·1	1027·1	4	E.
,, 18	825,000	55,000	315,000	14,970,000	10·0	7·2	1027·2	5½	
,, 19	600,000	..	,,	15,570,000	12·2	7 2	1027·0	8	
,, 20	..	70,000	3,000,000	12,500,000	14·5	7·4	1027·1	12	
,, 21	250,000	..	..	12,750,000	13·9	7·4	1027·0	10	
,, 22	300,000	..	..	13,050,000	12·3	7·3	1027·0	3	S.E.
,, 23	750,000	120,000	..	13,680,000	10·0	7·1	1027·0	2	S.E.; dull.
,, 24	740,000	..	..	14,420,000	10·6	7·2	1027·1	3	S.E.
,, 25	530,000	..	..	14,950,000	9·5	7·2	1027·0	5	
,, 26	600,000	80,000	3,750,000	11,720,000	12·8	7·3	1027·2	8	
,, 27	..	..	..	11,720,000	12·3	7·4	1027·1	14	
,, 28	1,200,000	..	..	12,920,000	13·9	7·8	1027·1	18	
,, 29	530,000	..	..	13,450,000	15·6	8·2	1026·9	20	
,, 30	420,000	90,000	..	13,780,000	18·9	8·7	1027·0	17	E.
May 1	300,000	..	525,000	13,555,000	12·8	8·4	1027·1	5	E.
,, 2	290,000	..	..	13,845,000	13·9	8·3	1027·0	3	N.E.
,, 3	300,000	80,000	..	14,065,000	12·8	8·5	1027·2	8	
,, 4	130,000	..	..	14,195,000	11·7	8·4	1027·1	2	Dull.
,, 5	110,000	30,000	2,250,000	12,025,000	11·1	7·7	1026·9	4	S.E.
,, 6	80,000	..	..	12,105,000	13·4	8·1	1026·9	5	
,, 7	50,000	..	..	12,155,000	16·7	8·4	1027·2	8	
,, 8	40,000	25,000	1,000,000	11,170,000	18·4	8·6	1027·1	9	
,, 9	..	115,000	4,750,000	6,305,000	15·6	8·5	1027·2	10	
,, 10	..	..	..	6,305,000	14·5	8·7	1027·0	16	
,, 11	..	..	..	6,305,000	15·6	9·0	1027·2	18	
,, 12	..	..	..	6,305,000	19·5	9·1	1027·1	18	
,, 13	..	..	..	6,305,000	16·7	9·3	1027·0	12	
,, 14	..	35,000	..	6,270,000	17·8	9·0	1027·1	8	E.
,, 15	..	..	..	6,270,000	16·1	8·9	1027·2	6	E.
,, 16	..	..	..	6,270,000	15·6	9·0	1027·0	5	S.E.
,, 17	..	..	..	6,270,000	17·3	8·7	1027·1	3½	S.E.
,, 18	..	..	..	6,270,000	12·8	8·8	1027·1	2½	S.E.; dull.
,, 19	..	..	..	6,270,000	13·4	8·9	1026·9	3	E.
,, 20	..	..	..	6,270,000	11·1	8·7	1026·9	3	E.
,, 21	..	..	1,300,000	4,970,000	12·3	8·8	1027·1	4	S.E.
,, 22	..	..	4,970,000	..	13·4	8·8	1027·2	7	S.E.
Total	27,250,000	1,190,000	26,060,000						

As thousands of gallons of water were constantly passing through the pipes, the variations in the temperature of the air had very little influence on the temperature of the water, as may be seen from the table. The greatest difference observed in the temperature of the water between the harbour and the hatchery was 0·5° C. The temperature of the water in the pond varied very little, and was practically the same as the temperature of the sea at the time.

The specific gravity was high and very constant, the average being a little more than 1027·0. On one occasion it fell to 1026·4, and on only nine occasions was it below 1027·0; the maximum observed was 1027·3.

The high specific gravity and its constancy are of immense importance for hatching operations, as the system is based on the buoyancy of the fish eggs. The specific gravity of the eggs of the plaice is about 1024·6.

Besides being of importance in itself, the high specific gravity decreases very much any ill effects from muddy water that should happen to pass through the filters, as the eggs remain constantly buoyant.

The transparency of the water was observed by means of a white disc, about 1½ feet in diameter, similar to that used on board the 'Garland,' which was lowered into the water in the harbour as far as it could be seen when put in slight horizontal motion. Of course the height of the sun, the transparency of the air, &c., had an influence on these observations. To decrease the inaccuracy as much as possible, the observations were always carried out on the same spot, and nearly at the same time (noon). On a dull day, if the sun happened to be clear for some time, the observation was then made.

From the beginning of the season to the 14th of April the winds were blowing off shore, and the water all this same time was very clear. From Table III. it will be seen that the diminished transparency was always caused by winds blowing in from the sea—N.E., E., and S.E. As the coast is unsheltered in these directions, winds from these points bring up a swell on shore, which stirs up the very fine sand lying around the rocks. This kind of fine sand that on these occasions is mixed up in the water will pass through the tightest flannel-filters, and can only be kept back by a still finer stuff. I succeeded in doing so, and at the same time I found the sand that mostly looks like mud is easily brought to settle, however fine it is. Arrangements were made according to the experience gained, and gave a very satisfactory result. In fact, I was able to have quite clear water in the hatching apparatus, while the transparency of the water from the pump by easterly swells was decreased to 3 feet or so.

Immediately after hatching, and during the following thirty-six to forty-eight hours, the fry of the plaice remain inert and quiescent, and very often lie upside down, with the yolk-sac floating on the surface. The young fish may now and then make a jerk, which carries it away an inch or so.

If not exposed to a constant current, the fry do not in confinement pass very easily over this stage of their life, judging from a few very young ones that were put into a large glass jar. In four days about half of them died. On the other hand, I ascertained that they had a good supply of water, which was constantly and gently going into the jar, but through four different tubes, so arranged that no visible motion was caused by it. After the first stage, which seems to last from thirty-six to forty-eight hours, the fry in the hatching-boxes being exposed to a constant and considerable *current* of water, gradually turn round into the right position, and begin to strike against the stream. From the age of about four days, and later, as long as the yolk-sac lasts, the fry in the boxes are always to be seen in that position—striving against the current, one beside the other. At the same time, the vividness of their yellow pigment colour is

much increased, while the fry themselves are comparatively strong and lively, always being in activity. Such was not the case with those in the calm water in the jar—they had all the while the original pale yellow colour; and instead of going toward the light, as a healthy one will always do, they gradually dropped down to the bottom, standing on their head—an attitude that shows their strength has gone, and that they are going to die.

The fry were kept in the hatching apparatus till the yolk-sac was nearly absorbed—that is to say, from ten to fourteen days. They were then transferred to the waters of the Firth of Forth and St Andrews Bay, as follows:—

TABLE IV. *Showing the Localities where the Fry were put into the Sea.*

Date.	Locality.	Specific Gravity at the Surface.	Specific Gravity at the Bottom.	Temperature of the Surface.—C.	Temperature of the Bottom.—C.	Transparency. Fathoms.	Depth. Fathoms.	Number of Fry put out.
March 29	Firth of Forth, 3½ miles N.E. of Fidra	1027·1 (10·5)	1027·5 (10·4)	6·9	4·9	2½	28	325,000
April 11	Do. do. do.	1027·2 (7·2)	1026·8 (12)	6·6	6·8	1½	5	1,875,000
„ 14	Do. 6 miles N. of Cockenzie	1027·0 (8·1)	1027·2 (9·1)	6·5	6·4	3	9½	2,000,000
„ 18	Do. do. do.	1027·2	..	7·2	..	1	4	315,000
„ 20	Do. 4 miles N.E. of Fidra	1026·8 (10·6)	1026·9 (10·9)	7·2	6·9	3	9½	3,000,000
„ 26	Do. do. do.	1027·2 (7·9)	..	7·4	6·7	3	12	3,750,000
May 1	Off Belhaven Sands	1027·1	..	8·4	..	1½	5	525,000
„ 5	St Andrews Bay, 2 miles off shore .	1027·1 (8·2)	..	7·3	7·0	„	7½	2,250,000
„ 8	1 mile off Dunbar	1027·1	..	8·6	„	1½	12	1,000,000
„ 9	St Andrews Bay, 6 miles off shore .	1027·0 (8·3)	..	7·6	6·7	..	13	4,750,000
„ 21	Off Dunbar	1027·1	..	8·4	„	4	5	1,400,000
„ 22	1½ mile N.E. from Bass Rock . .	1027·2	..	7·9	„	2½	22	4,870,000
								26,060,000

The hatching apparatus is intended to keep the fry while they are nourished from the yolk-sac. As the water-supply must be filtered, most, and perhaps all, the food that is suitable for the fry in the later stages, will be removed in filtration. If fry were kept in the boxes after the

yolk-sac is absorbed they would soon starve, and such was the case with a few that were kept back on purpose. They got pale and quiet, and were inclined to drop down on their heads to the bottom.

Some others were put into glass jars at the stage when they generally are transferred to the sea. Here they remained in a thriving condition as long as a good supply of food could be obtained and a gentle but constant current of clean water was passing through. At first the circulation was kept up by syphons only. This arrangement was good enough for the purpose, but required more attendance than always could be paid to it during the night; so I had the supply brought directly from the main pipe from the pumps by pressure. At the same time the water thus obtained consisted of unfiltered water containing natural food. If this water had been always free from deposits of different kinds, the last arrangement would surely have given a satisfactory result; but the water going out from the jars had to pass through sand on the bottom, which was put in to keep the fry back. As soon as the deposit from the water from the harbour had accumulated on the sand, the circulation gradually stopped, and the water flowed over during the night, carrying away the fry. In that way the oldest fry I ever had—30 days of age—were carried away, and no specimens were left for preserving.

The fry of this experiment had all the while the strong yellow colour which is known from the hatching boxes as the mark of a healthy and strong plaice at that age.

The last experiment was carried out in the little tank-house of the laboratory, where the sea water is pumped up by a small water motor. Here it was necessary to work with filtered water, and I had to collect the food by tow-netting in the harbour. But stormy weather put an end to this experiment, too, as a quantity of deposit of different kinds was mixed amongst the food, and was not easily separated. The fry was this time kept to an age of 20 days. While the pumps were working, the food for the fry in the jars was obtained from the water supply going into the pond by tying a bag of cheese-cloth over the end of the pipe.

As will be seen, accidents of different kinds put an end to these experiments; but judging from the experience gained, I think rearing of plaice fry on a small scale could be carried out in jars with good result. On the other hand, a suitable pond would be preferable, and give a satisfactory result.

One of the accidents that occurred was rather strange. The water being contaminated with a quantity of sediment, I one day put air into it on its passage, to decrease the required supply. The air became mechanically mixed with the water. But the fry swallowed the minute air-globules, which, when collected in the stomach, distended it. After some time the fishes were floated up to the surface by this accumulation of air, and died in a few hours.

Besides the plaice which, as has been described, were hatched on a large scale, experiments were made on the eggs of cod and of the flounder (*P. flesus*). From the 'Garland' were obtained about half a million of cod ova, which hatched in fourteen days, the average temperature of the water in the hatching apparatus being 6·52° C. All the ova received were fertilised, and the death-rate amongst them during the hatching process was very low—not above 4 per cent. The cod fry were put into the sea off Dunbar.

Of. *P. flesus* I myself fertilised some thousands of ova on the 'Garland,' which hatched in six days, the water having an average temperature of 6·12° C.

As in the case of the cod eggs, nearly all those of the flounder also hatched successfully.

The favourable results obtained in the hatching operations at Dunbar Marine Hatchery this season are, I believe, due very much to the suitability of the system of hatching apparatus made use of, and to the favourable conditions of the sea water on the shore.

The water has during my stay here (about five months) generally been very pure, and if the fine sand and deposit lying along the rocks on occasions is stirred up by stormy weather from the sea, the ill effects of this for the hatching operations is much decreased by the high and constant specific gravity of the water; and when the experiences gained are properly utilized, thousands of gallons of pure sea water can be obtained at any time without difficulty.

During the season some of the American jars for hatching buoyant fish ova were tried as an experiment.

SECTION B.—BIOLOGICAL INVESTIGATIONS.

I.—CONTRIBUTIONS TO THE LIFE-HISTORIES AND DEVELOPMENT OF THE FOOD AND OTHER FISHES.

By Professor M'Intosh, M.D., LL.D., F.R.S., F.R.S.E., &c., St Andrews Marine Laboratory. (Plates II.–IV.)

CONTENTS.

	PAGE
1. Additional Observations on the Eggs of the 'Saithe,'	218
2. On the Ova and Larva of the Turbot (?),	222
3. On an Unknown Egg with an Oil-Globule 1·2573 in diameter,	224
4. On *Lumpenus lampetræformis*, Walb.,	225
5. On the Norwegian Topknot,	227

1. Additional Observations on the Eggs of the Green Cod or 'Saithe.'

In the Tenth Annual Report of the Board * a few introductory remarks were made on the eggs of the green cod—which hitherto had escaped observation (so far, at least, as accurate diagnosis went), notwithstanding that both adults and young fishes were common off the eastern shores. In the spring of that year (1892) Mr Duthie, the energetic assistant-Fishery Officer at Lerwick, forwarded a few unfertilised eggs, procured on the 9th April. Their condition, on reaching the laboratory, was unsatisfactory, since the capsules alone remained, the diameter of the most perfect of these being 1·1430 mm., a size which, it is interesting to note, corresponds very closely with that of the living egg, as will subsequently be shown. This was the first occasion on which these eggs were specifically separated. In the Eleventh Annual Report † a further note on these eggs was made, the continued exertions of Dr Fulton and Mr Duthie being successful in providing some living eggs from Shetland, which had been fertilised by the latter on the 31st March, and which reached the laboratory on the 3rd April. As far as possible these were examined by Mr J. M. Anderson, M.A., B.Sc., during my absence, but their vitality was impaired, and, though one or two almost hatched, yet no free larva was seen.

Various attempts had been made to secure these eggs off the east coast by sending the laboratory attendant on board steam-liners and other vessels, and by the examination of the green cod captured by the herring-boats off the Forth. Ripe males were occasionally found; but no ripe females. Thus, on the 17th January of this year (1894), a female, 3 feet

* Page 287. † Page 242.

6 inches long, landed at Anstruther, had ovaries weighing 1 lb. 13 oz., but the eggs were all small, ranging from ·3810 mm. to ·6096 mm.

By various inquiries Dr Fulton ascertained that one of the most promising localities was Gairloch, Ross-shire, and accordingly the laboratory attendant (A. W. Brown) was sent there in the second week of February. He found that in a single haul of the gill-nets, off the mouth of the loch (near the Minch), occasionally as many as 640 green cod, besides 60 cod and other fishes, were secured. Each gill-net is 80 yards long, with meshes 8 inches from knot to knot diagonally (or about 4 inches from knot to knot round the square). It is 40 meshes deep, or about 26 feet 8 inches; is furnished with corks on the top, and heavily weighted with stones on the lower border. The boats have a keel of 18 feet, and a length on deck of 24 feet. Each has five men on board. Many ripe fishes * were at once obtained, and the water in the loch teemed with the eggs of the same species. The first series of the eggs of the green cod, fertilised on the 15th February at 2 P.M., passed through the early stages on this and the 16th, and on the 17th were in the mulberry stage. The blastoderm had made considerable progress on the 19th; and on the 20th February at 3 P.M., when they reached the laboratory, the blastopore had closed, and 8 or 9 muscle-plates had formed (Pl. II. fig. 1). Kupffer's vesicle was present in some.† Many of the embryos show minute black specks along the body, and in one a black chromatophore occurred in each eye. The yolk presents a slightly wavy aspect, which is rendered evident by careful adjustment of the focus, and the same feature was noticed in the previous examples. The eggs are extremely buoyant, and measure 1·1430 mm., a size which exactly corresponds with the empty capsules formerly alluded to, but it is considerably larger than those sent last year from Shetland.

21st February, 4 P.M. The black pigment in some is more distinct along the body of the embryo, being grouped chiefly at the sides, yet in front a few specks invade the median region behind the eyes (Pl. II. fig. 2). In others, however, the pigment occurs posteriorly over the body generally. Though the tail is somewhat longer than in fig. 2, Pl. IX., of the Eleventh Annual Report, the muscle-plates are less distinct. The alar expansion is little marked, except in the pectoral region. An abnormal egg (Pl. II. fig. 9), discovered by Mr H. C. Williamson, M.A., B.Sc., presented a deviation of the notochord to the right (left in the figure), and Kupffer's vesicle was also on one side of the median line. Next day all the organs were more clearly outlined, the muscle-plates were more numerous, the lenses more distinct, and the pigment dotted all over the body (Pl. II. fig. 3), though in a few it was more sparse than in the figure. The early condition of the auditory organs in this form is interesting; and, in addition to what is given at pp. 760 and 761 of the Researches,‡ it may be mentioned that in the green cod, after the solid thickening of the sensory stratum of the epiblast has formed, the lumen, instead of being spherical, is elongated antero-posteriorly (Pl. II. fig. 8), the slit being somewhat spindle-shaped. No cellular elements in the audi-

* The adult fishes are either salted, and, by-and-by, in suitable weather, dried on wooden frames on the spot, or forwarded to Port Henderson for this purpose. The absence of communication prevents their sale in the fresh condition; though cod are forwarded fresh to Strome Ferry.

† The ease with which such ova can be sent long distances was again illustrated by these specimens. They were sent from Gairloch to Strome Ferry (a distance of about 45 miles) by a coal-boat, and thereafter carried by railway to Inverness and St Andrews, reaching the laboratory on the 5th day in excellent condition. Earthenware jars, tied over with cheese-cloth (so as to permit aeration), are found very suitable for transmission.

‡ *Trans. Roy. Soc. Edin.*, vol. xxxv., pt. iii., 1890.

tory cysts can be made out in the living form probably from the extreme delicacy and transparency of the tissues. Kupffer's vesicle is still present in some. A solid longitudinal bar occurs in the region of the heart, and a curved transverse line behind it. The comparative narrowness of the body of the embryo is a feature at this stage. The temperature was low, so that development went on slowly. On the 23rd February the tail extended considerably further round the yolk. The latter, moreover, has a peculiar oleaginous aspect, refracting the light, and occasionally showing a few streaks in its substance, which is not much diminished. The notochord is undifferentiated. Kupffer's vesicle is still visible. The black pigment is more distinct, and some chromatophores are slightly stellate. The slits in the otocysts are now ovoid, and proportionally shorter than yesterday. A lateral view of a specimen, of date 24th February, to indicate the pigment, is given in fig. 4, Pl. II., while a more advanced larva, with otoliths, is given in fig. 6 of the same plate. As usual, considerable irregularity exists in regard to the degree of development in such a series. One or two otoliths, as a rule, are present. A few pigment specks occur on the yolk, at the sides of the alar expansions.

On the 25th February the otocysts form broadly ovoid chambers, with two otoliths. The heart shows internal papillæ, but no trace of movement. The pectoral expansions are larger, and the notochord cellular. The pigment-spots are stellate, and some stretch beyond the line of the body into the yolk. The gut (*g*) forms a pale band (Pl. II. fig. 5). The following day distinct contractions occurred in the trumpet-shaped heart. Two otoliths are present in each otocyst, and occasionally one has three. The pectoral expansions are larger, and the lumen of the gut distinct. Only a trace of Kupffer's vesicle was seen in one example. The black chromatophores are larger, and eight or nine are placed on the head. Very little pigment occurs on the yolk, only a few stellate patches close to the trunk of the embryo. The tail extends almost round the yolk.

A considerable number were hatched on the 27th February, or 12 days after fertilisation, the larvæ floating, as usual, with the yolk-sac uppermost (Pl. II. fig. 7). They differ in the distribution of the pigment from the larval cod, for the chromatophores are scattered, and do not form the characteristic bars of the latter species. This, indeed, was surmised last year, from the condition of the embryo just before extrusion. On the following day (28th February) the lumen of the gut was smaller than at first, and the liver formed a granular swelling on each side in ventral views. The pectoral folds are larger. The yolk still shows a somewhat wavy structure (Pl. II. fig. 10), the figure representing an example in which the pigment is comparatively scanty; but many of the chromatophores are finely ramose, especially on the head (Pl. II. fig. 11).

The larval fish became more active on the 1st March, darting forwards on the least irritation. The otocyst now shows a double margin. A strand indicating the œsophagus extends in front of the lens. Two minute vesicles occur in the body opposite the pectoral fins, and appear to be the ends of the segmental ducts. The liver is slightly larger. The notochord reaches as far forwards as the eye, and posteriorly its point is nearer the caudal border. Embryonic fin-rays extend from the notochordal axis in the tail a short distance outward. The rectal cone has moved slightly downward. Considerable differences exist in regard to the presence of the black pigment.

A second series, fertilised on the same day (15th), arrived at the laboratory on the 2nd March. These eggs had been kept in open vessels on the spot, and conveyed here in the larval condition, viz., about the second day after extrusion. A careful comparison with those hatched in the laboratory showed no difference of moment.

On the 3rd March, the larval green cod (Pl. II. fig. 12), for the most part, float in the water with the yolk-sac uppermost, but are active when interfered with. The liver has increased in size, and the urinary vesicle is more evident. The eyes now show minute black pigment-specks, and are slightly silvery. The chromatophores are everywhere more finely ramose, and are dotted over the head and body, being best marked over the pectorals, above the alimentary canal, in the region of the segmental ducts, and on the trunk a short distance behind the yolk-sac. In some, indeed, an approach is made to the pigment-bars of the cod. The tip of the tail is pale, and has the rudimentary embryonic fin-rays. Occasionally the yolk presents a minute oil-globule on one side —as an abnormality; but, after all, there is no great gulf between those yolks which possess oil-globules and those which do not.

The head of the larval fish, on the 5th March, stands out more clearly from the diminished yolk, and the chief changes are the increase of pigment in the eyes, the appearance of the gall-bladder, and the more conspicuous ramifications of the chromatophores (Pl. II. fig. 13). The pigment behind the yolk-sac is sometimes grouped in two bars, as in the figure. The embryonic caudal rays are now longer—a few reaching the margin. The pectoral fin is carried more or less erect.

The little fishes are likewise more restless, though still frequently floating with the yolk-sac uppermost. All, however, were not equally advanced, since some only hatched to-day, the cold sunless weather probably having retarded development. The arrangement of the pigment, as seen from the ventral surface, is shown in fig. 14, Pl. II., where the sense-organs are also indicated. The latter agree with those in the cod. The example just referred to represents an earlier and truly pelagic stage, when the fish floats with the yolk-sac uppermost, and only wriggles forward a little.

On the 7th March (Pl. III. fig. 5) the grouping of the pigment behind the yolk-sac was more distinct, and all the organs were advanced. On this and the following day, the mouth is slightly open, and the mandible projects outward. The embryonic rays in the caudal region extend further forward in the broad marginal fin. The rectum is still high up, and a considerable amount of yolk is present. The urinary vesicle in some is large. The development is comparatively slow; and, though specimens lived till the 13th March, the only changes were the diminution of the yolk-sac and the more general distribution of the black chromatophores over the surface of the body. When viewed from the ventral surface, however, most show a somewhat regular arrangement of pigment along the sides. The yolk-sac is finely reticulated (Pl. III. fig. 6). The rectum is nearly as shown in previous figures, for the marginal fin has not yet shrivelled.

The green cod thus closely approaches the cod in its development, but the arrangement of the pigment distinguishes it from a very early stage, though in the later stages of larval life the one approaches the other. It is probable that in former years the ova of this species, as well as the larvæ, occurred in various collections, but until now it has been difficult to predicate with certainty.

The earlier post-larval stages of green cod are still in need of observation. A form procured in the bottom-net on the 15th March (Pl. III. fig. 7), and measuring 9·25 mm. in length, is probably a young green cod, though the black pigment is less developed than in some of the younger forms. Permanent rays appear in the hypural region of the caudal, and the eyes are bluish-silvery, with black pigment along the dorsal margin. The abdomen has numerous black pigment-specks and is tinted reddish from the minute crustacean food. In contrast with this

example, it is interesting to compare two post-larval gadoids procured on the 4th May, and which probably represent the cod. The smaller is ·209 inches, and the larger ·226 inches long. Both have the choroidal notch inferiorly, bluish-silvery eyes, a faint greenish hue of the head and trunk, and the black pigment, instead of forming bars, has now grouped itself dorsally and ventrally at the margin of the trunk, as formerly mentioned in the description of the cod.* It is there stated that the eye of the green cod is somewhat larger proportionally, probably from the shorter snout, and the mandible of the cod is longer, features which appear to be borne out by the present figures. As no barbel is yet present this distinction is not available. In the subsequent stages the greater increase of the black pigment on the body and fins of the green cod, and the absence of the characteristic spots of the cod, are at once diagnostic.

2. On the Ova and Larva of the Turbot (?).

In former Reports various remarks have been made concerning the reproduction and development of the turbot. It was also alluded to in the Trawling Report and in the 'Researches' in connection with the egg F (probably the topknot). On the 10th July 1884, the ripe ova of a turbot of 12 lbs. was procured about 63 miles E. by S. of the Isle of May, but all that could be done at the moment was to see that they were pelagic, and preserve them, after failing to secure a male. It was observed that the eggs were small—only a little larger than the rockling—and the embryos, many of which were hatched from pelagic ova captured in the same ground, were small. Though preserved in spirit, the oil-globule in the eggs is rendered distinct by treating with the usual solution now employed, viz., equal parts of spirit, 2 per cent. acetic acid and camphor.

Previous allusions to the reproduction of the turbot are comparatively meagre. Parnell† says:—'On the coast of Devon, turbot are taken in 'trawl-nets, but not in any numbers until they leave the rocky parts and 'approach the sandy ground to deposit their spawn. This they shed in 'spring.' Buckland‡ considered that it spawns in early summer, and that the young were seen in the pools in June and July by Mr Dunn, Mevagissey. Day,§ again, is of opinion that it breeds in summer. 'On 'February 15th, 1882, I found a female with nearly ripe ova. This fish 'had a very large number of small ova, and in a 23 lb. fish, which had 'ova weighing 5 lb. 9 oz., Buckland found 14,311,200 eggs.' Those observed by Fulton‖ were all unripe, though ranging from April to the 24th June. The largest hyaline ovarian ova were 0·97 mm. in diameter.

An examination of various ovaries of the turbot, kindly forwarded by Dr Fulton, and many from Iceland and other parts on the pontoon at Grimsby in 1891, gave some knowledge of the more or less ripe ovarian egg, one with yolk-spheres still present being figured in the *Tenth Annual Report of the Board.*¶ Mr Holt, on the 18th June 1892, found a ripe female on the pontoon at Grimsby, but was unable to procure a ripe male. The ova ranged from ·99 to 1·06 mm. In another example of the ripe turbot he ascertained that after formation of the perivitelline space the diameter was ·99 to 1·06, exactly as before, while he considers the usual diameter 1·01 mm. The oil-globule never varies more than from ·20 to ·21 mm., the latter being the usual dimensions. Few of the turbot that

* *Researches, Trans. Roy. Soc. Edin.*, xxxv., p. 818., Pl. xix., f. 2 and 3.
† *Fishes of the Forth* (Werner. Society), p. 375.
‡ *Rept., Scotland, England, and Wales*, 1879, p. 248.
§ *British Fishes*, II., p. 13.
‖ *Ninth Annual Report, Scottish Fishery Board*, p. 262.
¶ Plate xiv. fig. 1.

had been examined at Grimsby the previous year were very ripe towards the end of June, though many had a few translucent eggs here and there. In the turbot comparatively few eggs ripen at a given time. Thus, a female of about 30 lb. weight, when landed on deck, sent out a mass of ripe eggs measuring about 1½ oz. in bulk. This, probably, was an unusual quantity. In any case the large number of small eggs issuing at intervals provide for the safety of the species. The ripe males, as shown by Dr Fulton and others, are usually smaller than the females. As in the majority of flat-fishes, the ripe forms would appear to occur at considerable distance from land, so that the ova are disseminated by currents over a wide area of the ocean, and, after hatching, the larvæ drift about, assume the post-larval form, undergo transformation, and settle on the bottom. Either previous to, during the latter process, or shortly afterwards, many seek the margin of low water, and, as formerly shown, are caught in seine-nets or in shrimp-nets.

On the 28th April 1894, an egg was procured in the bottom-net in St Andrews Bay, which differs from any hitherto described, and corresponds with what was previously seen in the ovary of the turbot. The diameter is 1·0668 mm., while the pale oil-globule is 0·21 mm. or thereabout, both measurements agreeing with those communicated to me by Mr Holt, as indicated above. The blastopore has closed (Plate IV., fig. 1), and Kupffer's vesicle is present. The tail has not advanced beyond the yolk. The latter shows a few wrinkles or folds at the margin, and a peculiar mark at one place (apparently accidental). The perivitelline space is considerable. No lenses or otocysts are present. The yolk is dotted over with indications of pigment-specks, one or two lie over the oil-globule, and the same occur on the body and along the sides. No tint is visible under a lens, but under a low power of the microscope the margin of the yolk, the head and body have a yellowish hue.

Next day, 29th April, at 4.20 P.M., the embryo was distinctly tinted pale yellow under a lens, the most conspicuous chromatophores being over the yolk and the oil-globule. Kupffer's vesicle has disappeared, and the tail extends beyond the yolk, which has considerably diminished, as if progress were rapid. The otocysts are indicated by two ovoid translucent structures, and the heart is faintly outlined (Pl. IV. fig. 2). The temperature is comparatively high for the season, the sun especially being bright on the 30th April. The egg floated about 1 inch from the bottom of the vessel.

The larval fish had emerged before 8 A.M. on the 1st May, and measured 2·74 mm. The head, body, and yolk-sac are dotted all over with canary-yellow chromatophores, and at 11 A.M. a few had a tendency to throw out processes. The yolk-sac is more finely reticulated than in the topknot,* the minute vesicles or papillæ being much smaller, while they are not at all conspicuous on the body. Moreover, no ramifying dark pigment-corpuscles are present at the border of the marginal fin—dorsally and ventrally. The oil-globule occupies a corresponding position, viz., about the posterior third of the yolk-sac, as indicated in Pl. IV. figs. 3 and 4. The olfactory sacs, lenses, and otoliths (two in each otocyst, and in one a few additional granules) are present, but no pigment in the eyes. When viewed from the ventral surface, the pectoral thickenings are distinct, and the heart forms a papillose tube inclined to the left (right in figure). Traces of segmental ducts occur at the sides of the notochord, with enlargements anteriorly in the pectoral region. The alimentary canal terminates somewhat bluntly posteriorly, and granules lie in the centre a short distance within the tip. A band from the urinary vesicle and the end of the gut passes to the fin-border a short distance behind the yolk, the distinction

* *Researches*, Pl. xvii. fig. 4.

in this respect between the turbot (?) and the topknot, as figured by Prof. Prince, being marked. The preanal portion of the fin is very small in the turbot. In the figure of the larva of the former in the *Researches*, the strand of tissue just alluded to gives the impression of a rectum opening at the margin of the fin. Mr Holt drew attention to this feature by observing that in his examples of species F (topknot), the anus did not at first reach the edge of the marginal fin. The liver in the larva of the turbot (?) is in the form of a slight swelling on the gut. The notochord is multi-columnar. Two enlargements are seen at the sides behind the yolk, but they differ from the usual sense-organs. The larva is very buoyant, keeping quite to the surface of the water, so that currents waft it readily about in a vessel, and, moreover, it soon wriggles forward at short intervals.

The development in this form is comparatively rapid.

3. On an Unknown Egg with an Oil-Globule resembling that of the Sail-Fluke.

An egg was met with in considerable abundance in the tow-nets opposite the curing-station at Gairloch, Ross-shire, on the 21st March 1894. It had a diameter of 1·2573, the oil-globule ·3810. It thus differs from the egg of the hake (*Merluccius vulgaris*), as given by Raffæle, in being considerably larger, and in having a larger oil-globule (·94–1·03, and oil-globule ·27). Moreover, the surface of the egg is marked with minute translucent vesicles, so that it appears to be 'variolated,' a feature present in every example. It is somewhat larger than that of the sail-fluke (*Arnoglossus megastoma*), described in the Tenth Annual Report * (1·1430, and oil-globule, 3048), to which it had a superficial resemblance. Its minutely variolated surface, however, differed from the rugose zona of the sail-fluke, which agrees with the brill and lemon-dab in being everywhere covered with raised lines or ridges.

On arrival at the laboratory on the 2nd March, the embryro was considerably advanced (Pl. III. fig. 1), being about half round the yolk, with lenses and numerous muscle-plates. Kupffer's vesicle was still present, and the tail had not advanced much beyond the yolk. Shortly after the stage figured black chromatophores appeared over the oil-globule, and along the sides of the body, as seen, for instance, in the same form on March 4th (Pl. III. fig. 2). The pervitelline space has now grown larger—from the diminution of the yolk. One larva, apparently belonging to a different series, was freed on the 3rd March. In this (Pl. III. fig. 3) the yolk-sac was minutely dotted all over with vesicles connected by intervening lines, as in the larva of the top-knot. The large oil-globule is situated posteriorly, as in *Arnoglossus*, and in lateral view (Pl. III. fig. 4) it assumes a slightly flattened outline. A small pre-anal portion of the marginal fin is present. The notochord is multi-columnar. The heart is visible on the left side. No pectoral expansion is yet present. A few black chromatophores occur on the head, along the sides of the body, and over the oil-globule. This larva floated passively in the vessel till the 6th March, the yolk-sac having considerably diminished. The black chromatophores are nearly uniformly distributed over the body from the head to within a short distance of the tip of the tail. None appear on the anterior part of the head, and none on the marginal fin; whereas, in the larval sail-fluke (*Arnoglossus*) formerly described, they occurred both dorsally and ventrally in the marginal fin. Absolute reliance cannot, however, be placed on a feature of this kind, since considerable variation may exist.

Though the spawning period of the sail-fluke was considerably later

* Page 292.

(viz., towards the end of May) in 1892, I should have been disposed to connect this egg with the former species, were it not that the structure of the zona, and the difference in size, so markedly separated them. Nothing is said about the condition of the capsule of the egg of the hake by Raffæle, and it also is larger than the egg of that species. The hake is a common species at Gairloch, but nothing is known of the sail-fluke, though it also probably occurs in the loch.

4. On *Lumpenus lampetræformis*, Walb.

This form was one of the additions to the British fauna made during the Trawling Expeditions for the Royal Commission (under Lord Dalhousie) in 1884, a fine male having been captured about 15 miles off St Abbs Head in 40 fathoms water. This specimen was described and figured with his usual care and accuracy by the late Dr Francis Day,* who laboured so long and so ably amongst British and Indian fishes.

The occurrence of a perfectly fresh specimen of a female caught by a hook at the edge of the gill-cover by a St Andrews liner (John Waters) about 10 miles south-east of the Carr lightship, on the 23rd February 1894 (Pl. III. fig. 10), gives an opportunity of making a few remarks on the coloration and other features of a British example. The fisherman, recognising it as a fish he had never before seen, brought it to the laboratory.

The species was first discriminated by Mohr in his Natural History of Iceland (1776), though the name, as Collett says, was given to it by Walbaum in his edition of Artedi's *Genera Piscium* in 1792. Various names were subsequently bestowed on it by the northern writers on fishes, as shown in Collett's excellent account—from examples collected in the Norwegian North Atlantic Expedition—1876–1878.† The only name that may be mentioned is that (*Stichæus*) adopted by Dr Günther in his *Catalogue* ‡ and *Introduction to Fishes*.§ The total length of this female specimen was 9⅛ inches. The general colour was speckled greyish-brown with a faint olive hue, the whole dorsum being minutely dappled in this way. The specks over the dorsum and sides are small, while about seven larger touches occur on each side above the white line of the belly. Collett ‖ observes: 'Colour 'pale yellowish-brown, relieved with a number of greyish-brown spots, 'extending laterally along the body; the abdomen alone spotless, and of 'a somewhat more silvery appearance. These spots vary considerably in 'size; most middle-sized examples are marked with a row of eight, 'stretching along the sides below the mesial line, and occasionally, too, 'with a similar series above, the spots composing it, which sometimes 'extend beyond the bases of the dorsals, alternating with those in the 'lower row, the interspace always exhibiting spots and cloudings, the 'former frequently confluent.' The lozenge-shaped tail is prettily marked with seven vertical bars of the same hue. The pectorals have a faint greenish-yellow tinge towards the tip. The ventrals are white. Collett states they are without markings of any kind in the northern examples. The first part of the dorsal fin is somewhat lower than the succeeding, and has six rays and two olive-brown bands with a small third in front. The rest of the dorsal is bordered with olive-brown, and touches slant from above downward and backward at intervals. Collett describes the dorsal as 'marked with oblique transverse bands.' The anal fin is pale with white rays. The irides are olive-brown with a golden lustre. The cheeks are minutely dotted with the same pigment. The beautifully

* *Proc. Zool. Soc.*, June 17, 1884, Pl. xli.
† Christiania, 1880, p. 71.
‡ Vol. iii. p. 280.
§ Page 495.
‖ *Op. cit.*, p. 76.

regular rows of scales are visible to the naked eye, but more clearly under a lens.

In the original specimen the tail was thus described by Dr Day :— 'Caudal with one elongated ray above and another below, the five inter- 'mediate ones being somewhat concave, the remainder being shorter. Most 'probably this elongation is a sexual one, this fish being a male.' Mr Sim found the caudal of his examples quite different, being acuminate, as stated by Collett—that is, agreeing with the female example figured in the present paper. On examining the type-specimen in the University Museum here, it is apparent that the caudal rays have been dried, and are more or less adherent. Not one ray, however, but several rays, dorsally and ventrally, are longer, the intermediate ones being shorter, though to a less extent than Dr Day figures. These median rays seem to be more slender, and to shrink more in spirit, so that, if the longer rays were obliquely spread out (*i.e.*, dorsally and ventrally), and also the shorter external rays which pass from the base of the caudal over and under these, a different outline would readily be formed, indeed, it would approach that of the female. This interpretation, of course, is apart from the possible injury of these median rays in the specimen. Further, on examination of the well-preserved female above described, a somewhat similar appearance is observed—the longer dorsal and ventral rays projecting, and the median receding ; yet the form of the fin in the fresh condition was as shown in the figure. The foregoing observations, therefore, are given as a caution in regard to the apparently divergent condition of the tail-fin in the specimen first procured.

The ovaries were slightly developed and small, the eggs measuring from 0·2286 to 0·3048 mm., most ranging themselves round the latter diameter. They were therefore at a comparatively early stage, thus proportionately corresponding with those procured from the Moray Firth by Mr Sim, in which the roe was 'pretty well advanced at the end of April, much more 'so than the milt of the males,' though perhaps somewhat later in reaching the advanced condition. This, however, is more or less conjectural, for the ripe eggs are unknown.

Since the first recorded British specimen, Mr G. Sim has procured it frequently from trawlers working on the so-called 'witch' ground of the Moray Firth, and has written an interesting paper * on its habits, food, and distribution. Mr Thomas Scott, naturalist to the Fishery Board for Scotland, has also met with various examples off the Firth of Forth. The species, therefore, is probably an inhabitant of the deeper water all along the eastern coast of Scotland. Dr Günther, again,† records it from the west coast of Scotland (Dr J. Murray's collection, 1887–88), but he overlooks the original description ‡ of it as a British fish by Dr Day. Mr Sim seems to think that it is fossorial, but no certainty exists on this point, though allied forms have this habit.

'*L. lampetræformis*,' Collett states, 'is known to occur on the coast of 'Greenland, Iceland, Spitzbergen, and the shores of north-western Europe 'as far south as the Cattegat. But few examples of the species have been 'hitherto obtained from Greenland and Iceland. Off Spitzbergen, however, 'it has been repeatedly observed, individuals having been taken on each of 'the Swedish Expeditions to the Polar Sea, and its range extends as far 'north as 80°. Along the coast of Norway, from Finmark to the Christiania 'Fiord, it would appear to be rather a common fish in most localities. 'I once took as many as a dozen individuals at a single haul with a net in 'the Porsanger Fiord, West Finmark. The southern limit of its range is

* *Journal Linn. Society*, vol. xx. p. 38. Read 13th June 1886.
† *Proceed. Roy. Soc. Edin.*, vol. xv., p. 211.
‡ *Op. cit.*, 1884.

probably Bohuslen, in Sweden, one or two individuals having been obtained off Gothenburg (58° N.).'

It is an interesting fact that individuals taken on the southern coast 'of Norway and Sweden, when the temperature of the water is comparatively high, differ in no respect from those met with in the frigid 'expanse of ocean at the northern extremity of Spitzbergen.'

Two other species of the genus, viz., *L. medius* and *L. maculatus*, occur in northern waters, the former from Greenland and Spitzbergen, the latter from the same region, as well as the shores of Norway and the eastern coast of North America. In *L. maculatus* the anterior part of the dorsal is somewhat differentiated, being furnished with short sharp spines, with barely a trace of fin-membrane.

5. On the Norwegian Topknot, *Rhombus* (*Zeugopterus*) *norvegicus*.

The occurrence of a fine example of the Norwegian topknot on the 6th April, 10 miles S.E. of the Carr Lightship, is worthy of record, since it is a comparatively rare species on our shores. It was brought up by a hook apparently on a piece of sea-weed, though it is possible it may have been held by the gill-cover. The fisherman (Stewart Fenton) at once noticed its rarity, and brought it to the Laboratory.

The species was first described and figured as British by Mr Couch under the name of *Rhombus cardina*, Cuv., or Ekstrom's Topknot, from a specimen obtained in the Bristol Channel in 1863.* Dr Günther, who pointed out the distinction of the British form, procured off Shetland, and also that of Fries and Ekstrom, from the *Pleuronectes cardina* of Cuvier, gave it the name of *Rhombus norvegicus*.† No additional specimen was obtained until 1887–88, when Dr John Murray found several off the West Coast, and thus the late Mr G. Brook made no additional remarks on it in his interesting *Synopsis of the Topknots*, published in 1887.‡ Two of Dr Murray's specimens were $3\frac{1}{2}$ inches in length, the third less. Mr Holt § lastly procured an example, $3\frac{1}{8}$ inches long, in 30 to 31 fathoms, off St John's Point, Donegal Bay, in 1891, the soundings being sand, gravel, and rock.

The present example (Plate IV. fig. 5) is $3\frac{3}{8}$ inches, or 85 mm. long, and is a female, with developing ovaries. As Couch observes, the elongation of the body, in contrast with the other British topknots, is characteristic, but in the present example it cannot be said that the body is proportionally thinner than in the other forms. It is quite as thick. The scales are more distinct than in Müller's topknot, and probably also than in the others, considerably larger in proportion, and on the sides of the body are more elongated antero-posteriorly. The free edge of the scale is also conical (Plate IV. fig. 7), instead of forming a nearly straight spinous edge. This bluntly conical edge is beset with a row of slightly curved spines, usually numbering about 35 or 36, and more or less uniform in size, though the median or apical are generally a little larger, and a series of shorter spines, best marked at the apex of the cone, occur between and behind the others. On the white surface the shape of the scales is the same, but the median teeth appear to be a little larger. These scales pass on the base of the caudal on the right or white side, as Couch says, as far as they do on the left, but the fin-rays beyond have none. The character of the armature of the scale thus differs quite from the condition

* *Fishes*, vol. iii. p. 175, Pl. 167.
† *Cat. Fishes*, Brit. Mus., iv. p. 412.
‡ *Proceed. Roy. Phys. Soc. Edin.*, 1887, p. 362.
§ *Report, Roy. Dub. Soc.*

in the other forms, in which eight or nine spines occur—the median, moreover, greatly exceeding the others. The scales which cover the left surface of the fin-rays are more elongate, and show considerable variation in regard to the symmetrical position of the terminal spines, the character of which, however, remains the same. No scales occur on the right surface of the fin-rays. The ridge between the eyes formed a simple curve, spread out in front and behind, and thus, though agreeing with Couch's figure, differed from the examples from the West Coast, in which the ridge is described as ∞-shaped.* The lateral line deviated from the figure of both authors, since, though it inclined a little upward on approaching the pectoral, the abrupt upward curve did not commence till reaching a line falling within the tips of the pectoral rays, as both authors state in their descriptions. The teeth in the mandible and maxillæ form fine, almost villous, rows. None could be made out on the head of the vomer.

The dorsal fin begins distinctly in front of the eye, and the first few rays have no scales. Couch observes that it commences barely in front of the upper eye. About four or five of the terminal rays posteriorly pass to the right (lower) surface (fig. 6), and Couch states that in this and the anal fin the terminal regions on the right are 'not so near the caudal as 'in the other species.' The processes certainly appear to be smaller. The longest rays occur about the posterior $\frac{1}{6}$th of its course—a feature not shown in the most recent figure.† The pelvic fins overlap, though quite separate from, the commencement of the anal, the longest rays of which occur opposite the longest rays of the dorsal. About the same number of rays pass to the right (lower) side as in the case of the dorsal. The right pectoral is considerably shorter than the left.

The colour of this example was remarkable, since a general roseate hue pervaded the left side, and is visible now after being preserved for six weeks in spirit, as indicated in the figure kindly drawn by Mr Masterman. No mention of such a hue occurs in the previous notices of the animal, and it is rare for such tints to persist in spirit. The entire left surface is marbled with touches of brown of varying shades, some being dark, others light, and no regularity appears to exist in their distribution, except that there is a tendency to transverse bars when the body is viewed obliquely. A marked black band occurs at the base of the tail, and a dark spot beyond it, and both dorsal and anal fins have a series of dark touches. The same exist in the caudal, in which they have a somewhat crescentic arrangement. Couch observes that 'the upper surface is yellowish-brown, 'mottled with darker brown over the head, body, and fins, with less ten-'dency to defined spots than in the other species.' Günther, again, states that it is 'brownish, marbled with darker; a large blotch at the com-'mencement of the straight portion of the lateral line, and a transverse 'band on the tail behind the dorsal and anal fins, are the most conspicuous 'markings. The rays of the vertical fins are irregularly annulated with 'blackish-brown.'

The ovarian eggs were small, ranging from 0·34 mm. to 0·152 mm. and under, so that the spawning period was probably not nearer than July.

* *Proceed. Roy. Soc. Edin.*, xv., p. 218.
† *Ibid.*, Pl. iv, fig. C.

DESCRIPTION OF PLATES.

Plate II.

Fig. 1. Egg of the green cod, on reaching the laboratory on the fifth day after fertilisation, viz., 20th February 1894. A slight differentiation of the yolk occurs in the centre. × 33.

Fig. 2. Egg of the same series, on the 21st February. Black pigment has now appeared on the trunk. × 33.

Fig. 3. Egg of the same form, on the 22nd February, showing a considerable increase of pigment on the central region of the body. Kupffer's vesicle is present. × 40.

Fig. 4. Lateral view on the 24th February at 3 P.M. The pigment is somewhat irregular in its distribution. The otocysts are present. × about 50.

Fig. 5. Embryo *in ovo*, viewed obliquely from the ventral surface, 25th February. The gut is evident at g. × 52.

Fig. 6. A more advanced specimen, with longer tail and with otoliths, 24th February. × 40.

Fig. 7. Larval green cod on extrusion, 28th February. The caudal region in the example is curved dorsally. × 33 diam.

Fig. 8. Anterior region of an embryo of the green cod, showing the first indication of the otocysts, 21st February. × 90.

Fig. 9. Abnormal egg of the same species in which the notochord trends to the left in the figure, and becomes indistinct. Kupffer's vesicle (Kv) is also on one side (right). × 40.

Fig. 10. Larval green cod of the first day, 27th February, from the ventral surface. × 33.

Fig. 11. Larval green cod of the second day, 28th February. The left otocyst has three otoliths in this example. The pigment is unusually scanty. × 35.

Fig. 12. Larval green cod on 3rd March. The black pigment is more or less ramose, and embryonic rays are indicated in the tail. × about 30.

Fig. 13. Larval green cod of the 5th March, viewed obliquely in a dying specimen. The yolk is irregular in outline. The black chromatophores show a tendency to group themselves in special areas, as in the cod. The caudal embryonic rays are well marked. × 35.

Fig. 14. Ventral view of another example, somewhat later, escaping from the egg on the same date, with the pectorals outlined, and a few black chromatophores on the yolk-sac in front of them. × 33.

Plate III.

Fig. 1. Unknown egg captured at the surface in Gairloch, Ross-shire, 21st February. Figured on 3rd March. × 33.

Fig. 2. The same form, on the 4th March, obliquely seen from below. Black pigment is now present at the oil-globule. × 35.

Fig. 3. Larval fish from the foregoing, seen as floating at the surface, 3rd March. × 45.

Fig. 4. Larval fish from the same series, viewed laterally on the third day, and measuring 1·9 mm. in length, 6th March. × 45.

Fig. 5. Larval green cod, 7th March, from the series fertilised at Gairloch on the 15th February. The black pigment is grouped in bars posteriorly as in the cod. × 21.

Fig. 6. Reticulated surface of the yolk-sac of the green cod of 13th March. × 52.

Fig. 7. Post-larval fish, 9·25 mm. long, captured in the bottom-net in St Andrews Bay on 15th March, and resembling a young green cod. × under a lens.

Fig. 8. Post-larval gadoid, ·209 inches long, procured in the bottom-net in St Andrews Bay on 4th May 1893. The tail is somewhat shrivelled. Enlarged under a lens.

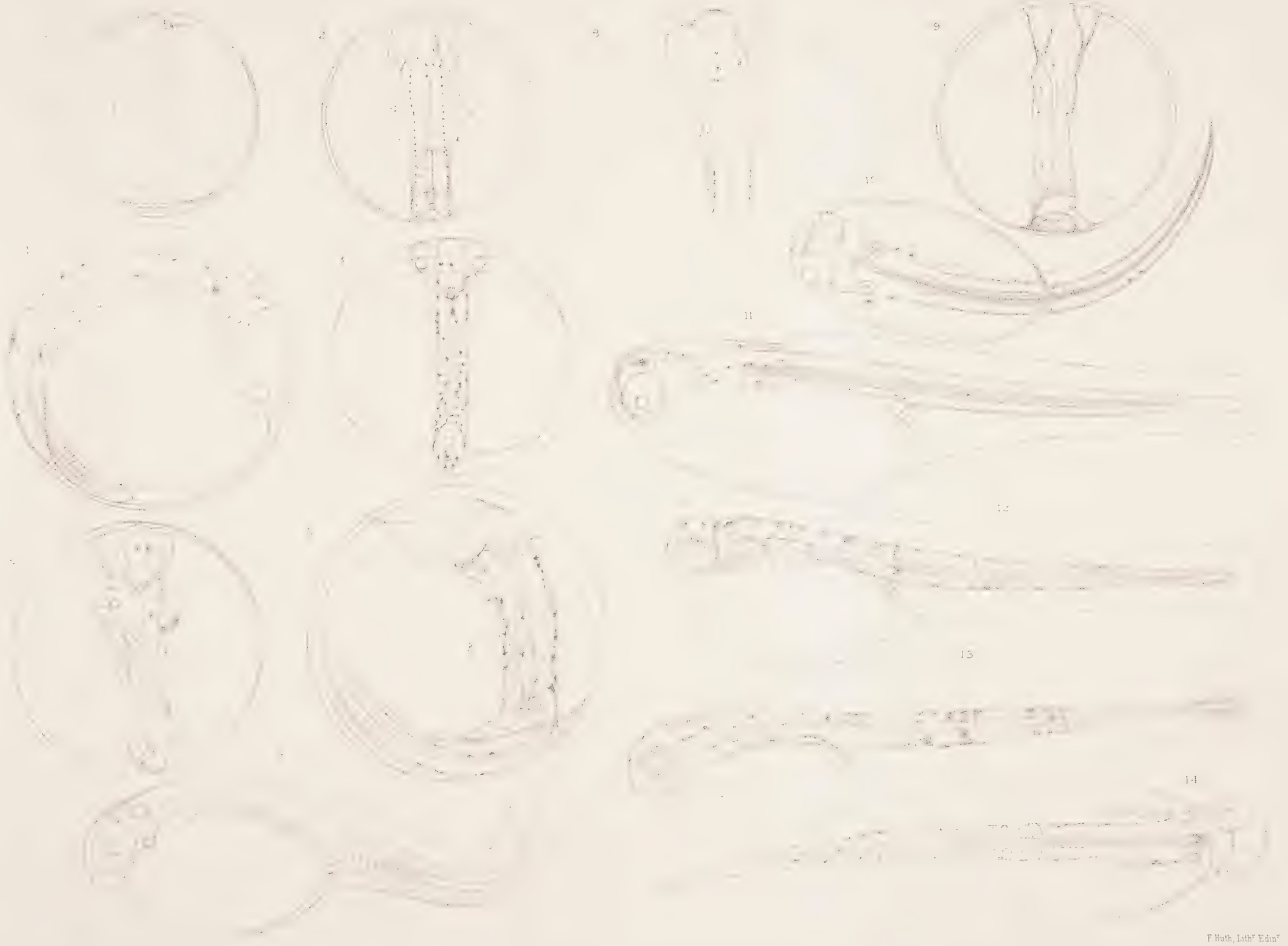
Fig. 9. Post-larval gadoid, ·226 inches long, obtained on the same date, and closely resembling the cod. The marginal fin is more or less folded from post-mortem changes. Enlarged under a lens.

Fig. 10. *Lumpenus lampetræformis*, Walb. About natural size. The specimen was captured south-east of the Carr lightship.

Fig. 11. Ovaries and testes of cod from Leith.

PLATE IV.

Fig. 1. Ovum resembling that of the turbot, at 4 P.M., 28th April 1894. The yellow pigment is represented by black points. × 35.
Fig. 2. The same egg next day at 4 P.M. The otocysts and lenses are present. × 35.
Fig. 3. View of the larva from the foregoing on the 1st day (1st May) as it floats on the surface. Length, 2·74 mm. × 35.
Fig. 4. Lateral view of the same on a slide, similarly magnified.
Fig. 5. Norwegian topknot. Natural size. Drawn by Mr Masterman after preservation in spirit. Its colour, however, had not altered much.
Fig. 6. Termination of the dorsal and anal fins of the foregoing on the right (pale) side—at the base of the caudal. Enlarged under a lens.
ig 7. Scale of the Norwegian topknot. × 21.
Fig. 8. Transverse section of the pectoral fin of the very young grey gurnard before the separation of the free rays. × 50.
Fig. 9. Transverse section of the free ray of the adult gurnard. × 50.
Fig. 10. Transverse section of an ordinary ray of the foregoing. × 50.
Fig. 11. Longitudinal section of the free ray. × 50.
Fig. 12. Longitudinal section of the sensory stratum of the top of a free ray with its nerves. × Zeiss oc. 4, obj. D.
Fig. 13. Longitudinal section of the spinal cord of the foregoing. Enlarged.
Fig. 14. Ovaries and testis of a hermaphrodite cod from Dunbar, about natural size.
Fig. 15. Testis of the foregoing seen from the under surface.



W C M. del Fig 9, H C Williamson

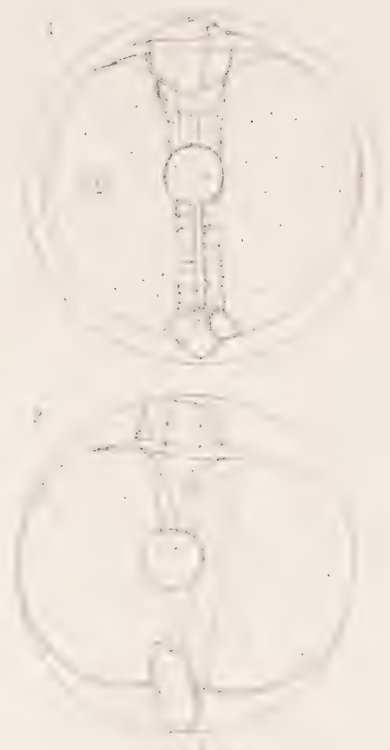
GREEN COD or SAITHE.

F.Huth, Lith^r Edin^r

Figs 1,5,6,7. W.C.M. Figs 2,3,4. H.C.W. Figs 8,9,10,11. A.T.M. del.

Fig 10. LUMPENUS LAMPETRÆFORMIS, Walb. (FEMALE).

P. Roth. Lith.r Edin.r



W C M del. Figs 1-4 & 7 A T M Figs 5,6,14 & 15 H C W cætera

II.—ADDITIONS TO THE FAUNA OF THE FIRTH OF FORTH.

Part VI. By Thomas Scott, F.L.S. (Plates V.–X.)

In my paper—'Additions to the Fauna of the Firth of Forth,' Part V. published in the *Eleventh Annual Report of the Fishery Board for Scotland* (1893), it is stated that some of the species that are there described for the first time had been known for some years previously, but had been allowed to stand over for want of sufficient information concerning them; the same statement may be made now, as not a few of the species recorded in the sequel have been in my possession since 1889, 1890, and 1891. There is nothing unusual in this, because an accurate knowledge of such small organisms, as many of the *Copepoda* are, and even of larger forms, can only be acquired by careful study extending over a lengthened period. Though much has now been done to throw light on the distribution of the Crustacean fauna of the Firth of Forth, my experience leads me to believe that much still remains to be done ere our knowledge of this group—a group that forms an important part of fish-food—attains to anything approaching completeness. In the present paper, the additions to the Forth fauna include 43 species of *Copepoda*, 1 species of *Ostracoda*, 10 species of *Amphipoda*, 1 species of *Annelida*, and 1 species of *Mollusca*,—in other words, 56 species of invertebrates, of which, so far as I know, no previous records of their occurrence in the Forth have been published, now fall to be added to those recorded in preceding papers. I again find it necessary to leave over several species of *Copepoda* for further study; the *Amphipoda* also require further investigation; and, thanks to the excellent work of Professor G. O. Sars of Norway, the study of this difficult group will, ere long, become comparatively easy. Very much, also, still remains to be done among the *Annelida* of the Forth. One interesting group—the *Nemertians*—has scarcely yet been touched; but the sea is a boundless storehouse whose treasures will never be exhausted.

Seventeen species of the *Copepoda* now recorded are described and figured here for the first time; preliminary descriptions of other 7 species new to science, and 1 new to Britain, have been published in the *Annals and Magazine of Natural History* for October 1893, and February 1894, and 1 species, new to Britain, is recorded here. A few of the others are new to the East Coast.* In my paper 'Additions to the Forth Fauna,' Part III. (*Ninth Annual Report of the Fishery Board for Scotland*, 1891), the following statement occurs:—'I venture to predict that when 'the Firth of Forth becomes more thoroughly and systematically worked 'up, the number of Crustacea will be little, if at all, short of 500 species.' In connection with this statement it may be of interest to mention that the number of species of Forth Crustacea, including those recorded in the present paper, now amounts to over 480.

My son, Mr Andrew Scott, has prepared all the drawings, and a large part of the necessary dissections required in the preparation of this paper. I may also say that, as in former years, the great interest taken in all our work, by Dr Fulton, has been a source of much encouragement. By his assistance, ever willingly given, I have been enabled to have the

* Several rare and new species have also recently been added to the British fauna from the Moray Firth District (see the parts of the *Annals and Magazine of Natural History* already referred to).

privilege of consulting literature that would otherwise have been difficult to get hold of. I have also to acknowledge my indebtedness to Mr Webster of the University Library for valuable assistance in this respect.

Before proceeding to describe the animals that have been added to the Forth fauna during the past year, it will perhaps be useful and interesting if in some measure, at least, I try to show what progress has now been made towards the attainment of a better knowledge of the Invertebrate fauna of the Firth of Forth through the investigations that have been carried on in the estuary under the direction of the Fishery Board for Scotland, and also the amount of success that has attended these investigations. For the present I can only indicate what has been accomplished in the study of the *Copepoda*, leaving the other groups to be dealt with later on. In this attempt to summarise the results of the work that has been done during the last few years among this important group of the Crustacea, I propose, in the first place, to give a list of all those species obtained in the Firth of Forth that have already been described and figured in the 'Monograph of the British Copepoda,' published in 1880; this will form a basis for, and an incitement to, further work by showing what blanks have yet to be filled up ere this part of the list can be considered complete. Second, I propose to give a list of those species obtained in the Firth of Forth which are not included in that Monograph, but have been added to the British fauna by other investigators since the publication of that work. A third list will include those species that have been added to the British fauna as the direct result of the Scottish Fishery Board's Investigations. And a fourth list will contain those species, apparently new to science, discovered during the progress of the investigations referred to.

The species are arranged in alphabetical order, and those described in this report are included with the others in the various lists.

List No. I.

The Copepods contained in this list include only those species that are described in the 'Monograph of British Copepoda,' by Dr Brady, published in 1878–80. (Fresh-water species are not included in the list.)

Acartia longiremis (Lillj.).
Acontiophorus scutatus (B. and R.).
Alteutha depressa, Baird.
,, *interrupta* (Goodsir).
Ameira longipes, Boeck.
Amymone sphærica, Claus.
Anomalocera patersonii, Templeton.
Artotrogus boeckii, G. S. Brady.
,, *magniceps*, G. S. Brady.
Ascidicola rosea, Thorell.
Calanus finmarchicus (Gunner).
Candace pectinata, G. S. Brady.
Canthocamptus palustris, Brady.
Centropages hamatus (Lillj.).
,, *typicus*, Kroyer.
Cletodes limicola, Brady.
,, ,, var. *gracilis*, Brady.
,, *longicaudata*, B. and R.
,, *propinqua*, B. and R.
Cyclopicera gracilicauda, G. S. B.
,, *nigripes*, B. and R.
,, *lata*, G. S. B.
Cyclopina gracilis, Claus.
,, *littoralis* (Brady).
Cyclops æquoreus, Fischer.
Cylindropsyllus lævis, Brady.
Dactylopus brevicornis, Claus.
,, *flavus*, Claus.
,, *minutus*, Claus.
,, *stromii* (Baird).
,, *tisboides*, Claus.
,, *tenuiremus*, B. and R.
Delavalia palustris, Brady.
,, *reflexa*, B. and R.
Doropygres normani, Brady.
,, (?) *porcicauda*, Brady.
Ectinosoma atlanticum (B. and R.).
,, *erythrops*, Brady.
,, *melaniceps*, Boeck.
,, *spinipes*, Brady.
Enhydrosoma curvatum (B. and R.).
Enterocola eruca, Norman.
Eurytemora clausii (Hoek).
Harpacticus chelifer (Müller).
,, *flexus*, B. and R.
,, *fulvus*, Fischer.
Idya furcata (Baird).
Jonesiella spinulosa.
Laophonte curticauda, Boeck.
,, *hispida* (B. and R.).
,, *horrida* (Norman).
,, *lamellifera* (Claus).

Laophonte longicaudata, Boeck.
,, *serrata* (Claus).
,, *similis* (Claus).
,, *thoracica*, Boeck.
Lichomolgus arenicolus, Brady.
,, *fucicolus*, Brady.
,, *furcillatus*, Brady.
Longipedia coronata, Claus.
Mesochra lilljeborgia, Boeck.
Metridia armata, Boeck.
Misophria pallida, Boeck.
Nannopus palustris, Brady.
Normanella dubia (B. and R.).
Notodelphys allmanni, Thorell.
,, *cerulœa*, Thorell.
Oithona spinifrons, Boeck.
Parapontella brevicornis (Lubbock).
Platychelipus littoralis, G. S. Brady.
Porcellidium fimbriatum, Claus.
Pseudanthessius liber (B. and R.)
,, *thorellii* (B. and R.)
Pseudocalanus elongatus (Boeck).
Pseudocyclops crassicornis, Brady.
,, *obtusatus*, B. and R.
Pterinopsyllus insignis, Brady.
Robertsonia tenuis (B. and R.).
Scutellidium fasciatum (Boeck).
Stenhelia hispida, Brady.
,, *ima*, Brady.
Tachidius brevicornis (Müller).
Temora longicornis (Müller).
Tetragoniceps malleolata, G. S. Brady.
Thalestris clausii, Norman.
,, *harpactoides*, Claus.
,, *helgolandica*, Claus.
,, *longimana*, Claus.
,, *rufocincta*, Norman.
,, *rufoviolascens*, Claus.
,, *serrulata*, G. S. Brady.
Thorellia brunnea, Boeck.
Westwoodia nobilis, Baird.
Zaus goodsiri, G. S. Brady.
,, *spinatus*, Goodsir.
Zosime typica, Boeck.

List No. II.

This list includes those Copepods discovered in the Firth of Forth that have been added to the British fauna either as new species or new additions by investigators other than those in the service of the Fishery Boards for Scotland, since the publication of 'The Monograph of British 'Copepoda.'

Acartia bifilosus, Giesbrecht.
,, *clausi*, Giesbrecht.
,, *discaudata*, Giesbrecht.
Eurytemora affinis, Poppe.
Jonesiella hyœnæ, I. C. Thompson.
Monstrilla rigida (I. C. Thompson).
Paracalanus parvus (Claus).
Stenhelia denticulata, I. C. Thompson.
,, *hirsuta*, I. C. Thompson.
Tachidius littoralis, Poppe.

List No. III.

This is a list of several described species of Copepods from the Firth of Forth that have been added to the British fauna as one of the immediate results of the investigations carried out under the direction of the Fishery Board for Scotland.

Bomolochus soleœ, Claus.
Herrmannella rostrata, Canu.
Lichomolgus agilis, Leydig.
Modiolicola insignis, Aurivillius.
Monstrilla helgolandica, Claus.
Oithona setiger, Dana.
Pseudanthessius gracilis, Claus.
,, *sauvagei*, Canu.

List No. IV.

This list contains all those species (including those in the present Report), apparently new to science, that have been discovered in the Firth of Forth during the progress of the investigations referred to.

Acontiophorus elongatus, T. and A. Scott.
**Ameira exigua*, T. Scott.
,, *exilis*, T. and A. Scott.
,, *longicaudata*, T. Scott.
* ,, *longiremis*, T. Scott.
* ,, ,, var. *intermedia*.
* ,, *reflexa*, T. Scott.
Artotrogus papillatus, T. Scott.
Canuella perplexa, T. and A. Scott.
**Cletodes curvirostris*, T. Scott.
,, *irrasa*, T. and A. Scott.
,, *lata*, T. Scott.
,, *tenuiremis*, T. Scott.
**Cyclopina elegans*, T. Scott.
Cyclopicera pupurocincta, T. Scott.
Cyclops ewarti, Brady.
Cylindropsyllus minor, T. Scott.
**Dactylopus coronatus*, T. Scott.
,, *rostratus*, T. Scott.

* New species described for the first time in this Report.

Delavalia æmula, T. Scott.
Dermatomyzon gibberum, T. and A. Scott.
Hersiliodes littoralis (T. Scott).
***Heteropsyllus curticaudatus*, T. Scott.
**Laophonte denticornis*, T. Scott.
* ,, *depressa*, T. Scott.
,, *inopinata*, T. Scott.
,, *littorale*, T. and A. Scott.
* ,, *simulans*, T. Scott.
***Laophontodes typicus*, T. Scott.
***Leptopsyllus typicus*, T. Scott.
Lichomolgus hirsutipes, T. Scott.
Longipedia minor, T. and A. Scott.
Neobradya pectinifer, T. Scott.
Paramesochra dubia, T. Scott.
Parartotrogus richardi, T. and A. Scott.
***Pontopolites typicus*, T. Scott.
**Pseudocyclopia caudata*, T. Scott.
,, *crassicornis*, T. Scott.
,, *minor*, T. Scott.
***Pseudowestwoodia andrewi*, T. Scott.
Stenhelia dispar, T. and A. Scott.
Stephos minor, T. Scott.
Tetragoniceps bradyi, T. Scott.
* ,, *consimilis*, T. Scott.
,, *incertus*, T. Scott.
,, *macronyx*, T. Scott.
Thalestris forficuloides, T. and A. Scott.

In the 'Monograph of British Copepoda' 131 species are described and figured exclusive of the fresh-water forms. In list No. I., given above, 95 of these are recorded for the Firth of Forth, or nearly 72 per cent. of the total number of species, exclusive of the fresh-water forms recorded for the British Islands in 1880. It will be observed from these statements that 36 of the marine species described in the 'Monograph of British Copepoda' have not, so far, been recorded for the Forth area. On the other hand, a considerable number of species have been discovered in the Firth of Forth, in addition to those described in the Monograph referred to, and the majority of these have been recorded for the first time for the British Islands, either as species that have been described by European and other writers, or as species new to science, as shown by the following summary of the four preceding Lists :—

In List No. I. 95 species are recorded for the Forth,	95
In List No. II. 10 species are recorded,	10
In List No. III. 8 species (new to Britain) are recorded,	8
In List No. IV. 46 species (new to Science) are recorded,	46
Total number of species of Copepoda recorded for the Forth, including those described in the present Report,	159
†Total number for the British Islands in 1880,	131
Excess of Forth species over those for the British Islands in 1880,	28

A few of the species included in this enumeration of the Copepoda of the Firth of Forth are probably somewhat doubtful, and may ultimately be set aside, as, for example, *Acartia bifilosus*, Giesbrecht, and *Oithona setiger*, Dana; but making all due allowance for such doubtful species, it will, I think, be acknowleged that, even in the department of Marine Natural History, a fairly successful endeavour has been made to take full advantage of the great and almost unique opportunities enjoyed for the prosecution of such studies.

I will now proceed to describe the various species of Invertebrates that have been discovered in the Firth of Forth since the publication of the Eleventh Annual Report of the Fishery Board for Scotland; and the Copepoda will be taken first in order.

* New species described for the first time in this Report.
** New genus and species described for the first time in this Report.
† This number is taken from the Index at the end of vol. iii. of the 'Monograph of British Copepoda.'

DESCRIPTION OF SPECIES.

CRUSTACEA.

1. COPEPODA.

Family Calanidæ.

Genus *Paracalanus*, Boeck (1864).

Paracalanus parvus (Claus).

1863. *Calanus parvus*, Claus (13),* p. 173, pl. xxvi. figs. 10–14; pl. xxvii. figs. 1–4.
1864. *Paracalanus parvus*, Boeck (5), p. 232.
1892. *Paracalanus parvus*, Canu (11), p. 169.
1893. *Paracalanus parvus*, I. C. Thompson (33), p. 7, pl. xv. fig. 5.
1894. *Paracalanus parvus*, T. Scott (30), p. 26, pl. i. figs. 1–19.

Habitat.—East of May Island, in a surface tow-net gathering. Frequent. Off St Monans. Not common.

Paracalanus parvus is easily distinguished from any other species of the British Calanidæ by the structure of the fifth pair of thoracic feet in both sexes. The only other British record for this species seems to be that of I. C. Thompson in the 'Copepoda of Liverpool Bay.' The distribution of the species appears to be world-wide; it has been recorded from the North Sea, from the Atlantic (North and South), from the Mediterranean, and from the China Sea.

Genus *Acartia*, Dana, 1846.

Acartia clausi, Giesbrecht.

1889. *Acartia clausi*, Giesbrecht (17), p. 332.*
1890. *Acartia clausi*, Canu, (10*a*), p. 326, pl. xxiv.
1893. *Acartia clausi*, I. C. Thompson (33), p. 8, pl. xv. fig. 6.
1894. *Acartia clausi*, T. Scott (30), p. 67, pl. vii. figs. 33–40.

Habitat.—Several parts of the Forth area. One of the chief characters that distinguish this species is the form of the fifth pair of thoracic feet. The fifth pair in the female are each armed with a stout and comparatively short apical spine in addition to the plumose seta. The following forms of Acartia are also obtained in the Firth of Forth, viz.:—*Acartia longiremis* (Lillj.), generally distributed, especially in the estuary proper. *Acartia discaudata*, Giesbrecht, off Musselburgh. *Acartia bifilosus*, Giesbrecht, West of Queensferry.

Family Pseudocyclopidæ, nov. family.

Body comparatively robust. Anterior antennæ short, sixteen to seventeen-jointed. Alike on both sides in the male, and similar to those of the female. Mouth organs and swimming-feet like those of the *Calanidæ*. Fifth pair in the female simple, one-branched, and two-jointed;

* The numbers in parentheses correspond with the numbers in the Bibliographical list at the end of the paper.

in the male dissimilar, and forming powerful grasping organs. The mandible-palp is comparatively small. One of the most prominent characters of this family is the structure of the anterior antennæ. The most careful observation failed to show any difference between the male right antenna and the left, and both were similar to those of the female. In my paper on the Forth Fauna, published in Part III. of the *Eleventh Annual Report of the Fishery Board for Scotland*, two species of Copepoda were described, for which it was considered necessary to institute a new genus (*Pseudocyclopia*). This new genus was placed in the family *Misophriidæ*, Brady, because of its closer affinity with that family than with the family *Calanidæ*. A further study of the characters of the genus has, however, led me to the conclusion that its position in the family *Misophriidæ* is untenable; and as there is no other family in which it can satisfactorily be included, I propose to constitute the family *Pseudocyclopiidæ* for its reception; and I do so with the greater confidence, as another species, now to be described, has recently been discovered, possessing all the more prominent characters that distinguish the two already described. Dr W. Giesbrecht, in his memoir 'Mitt-'heilungen über Copepoden' (Abdruck aus den Mittheilungen aus der Zoologischen Station zu Neapel, ii. Band 1.2. Heft), also refers to some of the peculiar characters of the two described species, and to the difference between them and those that constitute the family *Misophriidæ*.

Genus *Pseudocyclopia*, T. Scott (1892).

Pseudocyclopia caudata, sp. n. (Pl. V. figs. 1–8.)

Female. Like *Pseudocyclopia crassicornis*, T. Scott, in general appearance and dimension. Length, ·65 mm. ($\frac{1}{38}$th of an inch). Anterior antennæ seventeen-jointed. Basal joint very large, the others small; the second to the fifth gradually decrease in size, the sixth is rather longer than that which preceeds or follows, while the ante-penultimate joint is more elongate than any of the others except the basal joint. The formula shows approximately the proportional lengths of all the joints :—

$$\frac{29 \cdot 8 \cdot 7 \cdot 5 \cdot 4 \cdot 7 \cdot 5 \cdot 8 \cdot 6 \cdot 9 \cdot 7 \cdot 7 \cdot 8 \cdot 10 \cdot 16 \cdot 9 \cdot 12 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 \cdot 11 \cdot 12 \cdot 13 \cdot 14 \cdot 15 \cdot 16 \cdot 17 \cdot}$$

The posterior antennæ, mouth organs, and first and second swimming-feet are somewhat similar to those of *Pseudocyclopia crassicornis*. The basal spines of the third pair of swimming-feet, which reach to near the extremity of the outer branches, are very stout, and with the distal end boldly curved—the basal spines, very like those of *Pseudocyclopia minor*, T. Scott. The fifth pair are somewhat more robust than those of the females of the two described species, and are each armed with three stout sub-equal and setose terminal spines. The caudal stylets are nearly equal to the combined length of the last two abdominal segments, as shown in the accompanying figures.

Habitat.—Off St Monans. Scarce.

Remarks.—*Pseudocyclopia caudata* is similar in its general appearance to the two species already described; but is readily distinguished from both, even without dissection, by the comparatively elongate caudal stylets. The difference in the proportional lengths of the joints of the anterior antennæ, and in the structure of the third and fifth pairs of thoracic feet between this and the other two species, is also of sufficient importance for diagnostic purposes.

Family Misophriidæ, Brady (1878).

Genus *Misophria*, Boeck (1864).

Misophria pallida, Boeck.

1864. *Misophria pallida*, Boeck (5), p. 24.
1878. *Misophria pallida*, Brady (8), vol. i. p. 79, pl. xiii. figs. 11–16; pl. xviii. figs. 11–12.

Habitat.—Off St Monans, and also west of Queensferry.

Several specimens of this apparently rare species have been obtained at both the parts of the Forth area mentioned.

Genus *Pseudocyclops*, Brady (1872).

Pseudocyclops crassiremis, Brady.

1872. *Pseudocyclops crassiremis*, Brady (7*a*), vol. iv. p. 431, pl. xvii. figs. 1–8.
1878. *Pseudocyclops crassiremis*, Brady (8), vol. i. p. 82, pl. vii. figs. 1, 2; pl. xii. fig. 14.

Habitat.—Off St Monans. Rather scarce.

This seems to be a perfectly distinct species, so far as could be made out.

Family Cyclopidæ.

Genus *Cyclopina*, Claus (1863).

Cyclopina gracilis, Claus.

1863. *Cyclopina gracilis*, Claus (14), p. 104, pl. x. figs. 9–15.
1878. *Cyclopina gracilis*, Brady (8), vol. i. p. 93, pl. xxiv.B. figs. 1–9; pl. xci. figs. 10, 11.
1892. *Cyclopina gracilis*, Canu (11), p. 181.

Habitat.—Off St Monans, and various other parts of the Forth west to near Charleston.

This pretty and well characterised species is not uncommon within the Forth area.

Cyclopina elegans, sp. n. (Pl. V. figs. 9–19.)

Description.—Female. Length, ·83 mm. ($\frac{1}{30}$th of an inch). Body elongate, slender. Forehead narrowly and evenly rounded. Anterior antennæ rather shorter than the first cephalo-thoracic segment, and consisting of nineteen joints. The fifth to the ninth joints are very short, while the eleventh is about equal in length to the basal joint, and considerably longer than any of the others that preceed or follow, as is shown by the formula :—

$$\frac{12 \cdot 6 \cdot 5 \cdot 5 \cdot 3 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 11 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 5 \cdot 4 \cdot 6 \cdot 7 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 \cdot 11 \cdot 12 \cdot 13 \cdot 14 \cdot 15 \cdot 16 \cdot 17 \cdot 18 \cdot 19 \cdot}$$

The fourth joint appears to be composed of two coalesced joints, as a faint line could be observed extending from the upper margin to fully halfway across the joint (fig. 10). Posterior antennæ four-jointed, secondary branch obsolete or entirely absent (fig. 12). Mandibles well developed, and furnished with a large palp. The primary branch of the palp is elongate and three-jointed; while the secondary branch, which springs from the basal part of the primary branch, is short and four-jointed (fig. 13). The basal part of the maxilla-palp, which is delated

outwards, bears two distinct one-jointed branches on the exterior margin (fig. 14). Anterior foot-jaws four-jointed, with the basal joint very large comparatively, and the end joints small; the second joint is produced interiorly so as to form a base for a stout curved spine (fig. 15). Posterior foot-jaws elongate, seven-jointed, the last five joints small, their entire length being very little greater than the length of the second joint (fig. 16). Swimming-feet robust, both branches three-jointed. The marginal spines of the outer branches of the first pair are large and dagger-shaped, and project at, or nearly at, a right angle to the outer margin. Those of the fourth pair are much smaller, but the marginal setæ on both the outer and inner branches, but especially on the inner branches, are stouter than the marginal setæ of the first pair. In the first pair, also, a stout spine springs from the inner distal margin of the second basal joint, and projects downwards beyond the end of the second joint of the inner branches (fig. 17). Fifth pair stout, each consisting of a single three jointed branch. The breadth of the first two joints is greater than the length; while the third joint is longer than broad, being equal to the entire length of the first two. The first joint bears a moderately long plumose seta on the outer distal angle. The second joint bears a similar seta on the inner distal angle, while the last joint bears two plumose setæ on the inner margin, and one plumose seta and a dagger-shaped spine at the apex (fig. 19). Caudal stylets elongate, being equal to the combined length of the last two segments of the abdomen; and, in addition to the terminal setæ, each of the stylets bears one small hair near the proximal end, and another near the distal end of the outer margin. In the male the anterior antennæ are sixteen-jointed, the last six being more or less modified for grasping; the eleventh joint is comparatively robust and hinged to the preceding one. There is also a hinged articulation between the penultimate and ante-penultimate joints (fig. 11).

Habitat.—Off St Monans. Rather rare.

Remarks.—The species now described differs in some important points from any other *Cyclopina* recorded from the British seas. It resembles *Cyclopina littoralis* in the form of the fifth pair of thoracic feet, but the proportional lengths of the joints of the anterior and posterior antennæ, and the structure of the first pair of swimming-feet, are decidedly different. It also, in this respect, differs from *Cyclopina ovalis*, Brady; while the shorter and much fewer jointed anterior antennæ of *Cyclopina gracilis*, Claus, readily distinguish that species from the one now described.

Genus *Pterinopsyllus*, Brady (1880).

Pterinopsyllus insignis, Brady.

1878. *Lophophorus insignis*, Brady (8), vol. i. p. 122, pl. xiii. figs. 1–10; pl. xv. fig. 10.

1880. *Pterinopsyllus insignis*, Brady (8), vol. iii. p. 23. (*Lophophorus* being preoccupied, Dr Brady substituted the word *Pterinopsyllus* for this genus).

1893. *Pterinopsyllus insignis*, T. and A. Scott (32), p. 243.

Habitat.—West of Queensferry. Frequent. This beautiful species has several times been obtained in the part of the Forth estuary referred to. In this part of the Forth there are periodic and very marked variations in the salinity of the water; caused on the one hand by the ebb and flow of the tide, and on the other by the large volumn of fresh water from the river, which, forced back by the flowing tide, accumulates in the upper reaches, and, when the reflux takes place, rushes seawards with overpowering force, so that, during the later part of the ebb, and the early part

of the flood tide, there is a large admixture of fresh water in this portion of estuary of the Forth. It may be that the peculiar alternating conditions thus produced are favourable to the welfare of this and other organisms; but whether that be so or not, it is certain that *Pterinopsyllus* is comparatively frequent here, while it is apparently exceedingly rare where the more normal marine conditions prevail.*

Family HARPACTICIDÆ, Claus (in Part).

Genus STENHELIA, Boeck (1864).

Stenhelia hispida, Brady.

1880. *Stenhelia hispida*, Brady (8), vol ii. p. 32, pl. xlii. figs. 1–14.
1893. *Stenhelia hispida*, I. C. Thompson (33), p. 19.

Habitat.—Of St Monans. Rather scarce.

This, which appears to be a comparatively rare species in the British seas, is apparently widely distributed. It has been obtained at Tobermory (Rev. A. M. Norman); off Hartlepool and Marsden, Durham, and at Portincross, Ayrshire (Dr G. S. Brady); in Ventry Bay, Ireland (Mr E. C. Davidson); in rock-pools at Hilbre and Puffin Islands, at Garth Ferry, and in Port Erin Bay, Isle of Man (I. C. Thompson).

Stenhelia hirsuta, I. C. Thompson.

1893. *Stenhelia hirsuta*, I. C. Thompson (33), p. 20, pl. xxxi.
1894. *Stenhelia hirsuta*, T. and A. Scott (31), p. 146.

Habitat.—Off St Monans and at the north end of Inchkeith Island.

Mr I. C. Thompson, of Liverpool, obtained this interesting species amongst mud dredged from 29 fathoms in the Irish Sea, and about twelve miles west from Port Erin, Isle of Man. The females of this species carry two ovisacs as shown by Thompson's figure; and several of the specimens obtained in the Firth of Forth were also provided with two ovisacs.

Stenhelia dispar, T. and A. Scott.

1894. *Stenhelia dispar*, T. and A. Scott (31), p. 141, pl. viii. figs. 8–12.

Description.—Female. Length, ·55 mm. ($\frac{1}{46}$th of an inch). Rostrum of moderate length. Anterior antennæ short, moderately stout, and eight-jointed. the fifth, sixth, and seventh joints are small, but the last is about equal to the combined length of the two preceding joints, as shown by the annexed formula:—

$$\frac{27 \cdot 19 \cdot 13 \cdot 14 \cdot 6 \cdot 9 \cdot 8 \cdot 18 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot}$$

The posterior antennæ are somewhat similar to those of *Stenhelia ima*, Brady, except that the last joint of the secondary branch bears one marginal and one apical seta instead of two apical setæ. Mouth organs similar to those of *Stenhelia ima*. First pair of thoracic feet slender, and also somewhat like those of that species. A spiniform plumose seta springs from the lower margin of the second basal joint, and close to the proximal end, interiorly, of the inner branches; there are no setæ on the inner margin of the outer branches. The fourth pair are also somewhat similar to those of *Stenhelia ima*. The basal joint of the fifth pair is large and sub-triangular, and furnished with three setæ on the inner margin and

* My son obtained *Pterinopsyllus* in material from the Moray Firth dredged from a depth of 40 fathoms.

two at the apex. The secondary branch is comparatively small and broadly sub-ovate, with a somewhat bifid apex, and bears one seta on the inner margin, one on the outer margin, and one on each lobe of the bifid apex. Caudal stylets very short.

Habitat.—Vicinity of the Bass Rock. Rather scarce.

Remarks.—This is a small species, and resembles *Stenhelia ima* in several of its characters; but the short anterior antennæ, and the large basal joint, and comparatively small and broadly ovate secondary joint of the fifth pair of thoracic feet, readily distinguish it from that species.

Stenhelia denticulata, I. C. Thompson.

1893. *Stenhelia denticulata*, I. C. Thompson (33), p. 20, pl. xxx. figs. 1–11.

1894. *Stenhelia denticulata*, T. and A. Scott (31), p. 146.

Habitat.—Off St Monans, and in the vicinity of Inchkeith Island.

Mr I. C. Thompson obtained the two specimens, from which he described the species inside the breakwater, at Port Erin, Isle of Man. Several specimens have been captured in the Firth of Forth. This is a comparatively large and well-marked species. The anterior antennæ are moderately long and slender, and eight-jointed. The second joint from the base is armed with a strong forward-projecting tooth.

Genus *Ameira*, Boeck (1864).

Ameira reflexa, sp. n. (Pl. V. figs. 20–28.)

Description.—Female. Body moderately robust. Length, ·68 mm. ($\frac{1}{40}$th of an inch). Anterior antennæ short, stout, and eight-jointed. The first two joints are large, the others are small, the penultimate being shorter than any of the others. The upper distal portion of the fourth joint is produced forwards so as to form the base of a long filiment. The proportional lengths of all the joints are nearly as in the formula:—

$$\frac{16 \cdot 14 \cdot 6 \cdot 5 \cdot 4 \cdot 5 \cdot 3 \cdot 6 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot}$$

Posterior antennæ short, two-jointed. A small secondary branch springs from near the middle of the first joint, and is furnished with three terminal setæ (fig. 22). Mandibles small. Mandible-palp one-branched. The basal joint is small, and bears a single short terminal seta. The small one-jointed branch springs from the upper part of the external margin of the basal joint, and bears one marginal and three apical setæ (fig. 23). Posterior foot-jaws short, moderately stout, consisting of two subequal joints, the lower rounded margin of the second joint ciliated. Terminal claw nearly straight, and rather longer than the joint from which it springs (fig. 24). Both branches of the first four pairs of swimming-feet three-jointed; the outer branches of the first pair reach slightly beyond the end of the second joint of the inner branches. The first joint of the inner branches is stout, and somewhat longer than the second joint, and bears a moderately long plumose seta near the middle of the inner margin. The second joint—which is rather smaller than the first—is furnished with a similar seta near the distal end; while the last joint, which is slender, and fully one and a half times the length of the second, is provided with one moderately short and two long setæ at the apex, and three small spiniform setæ on the inner margin. The first and second joints in both branches are strongly ciliated on the outer margin. The first two joints of the outer branches are each armed with a moderately long marginal spine, and the last joint with two shorter marginal spines, and three plain terminal setæ (fig. 25). The outer

branches of the next three pairs are somewhat longer than the inner branches, and both branches are elongate, and moderately stout. In the fourth pair the first two joints of the outer branches are sub-equal, but the last is nearly equal to twice the length of the preceding one; the joints of the inner branches are each somewhat longer than the one preceding, so that the last is fully twice the length of the first. Both branches have the outer margin more or less ciliated, the marginal and terminal setæ are nearly all elongate and strongly plumose, and the marginal spines of the outer branches are slender (fig. 26). The basal joint of the fifth pair is broadly foliacous, the apical portion of which is sub-triangular and furnished with six setæ round the inner margin and end, the third one from the outside being very long. The secondary branch is comparatively small, oblong-ovate in form, and extends somewhat beyond the end of the basal joint. There are several setæ round the outer margin and apex (fig. 27). Caudal stylets short, being rather more than half the length of the last adominal segment. The principal terminal seta of each stylet is nearly twice the length of the second (fig. 28).

Habitat.—Off Musselburgh, Firth of Forth. Rather scarce.

Remarks.—In the structure of the anterior antennæ, and of the first and fifth pairs of thoracic feet, this species differs from any others known to me. Neither the anterior antennæ nor the first swimming-feet are those of the typical *Ameira*. The end joint of the inner branches of the first pair is, in *Ameira*, usually shorter than the basal joint, but in the species now described the reverse is the case; but otherwise there is nothing to distinguish it generically from *Ameira*.

Ameira longiremis, sp. n. (Pl. V. figs. 29–32; Pl. VI. figs. 1–5.)

Description. — Female. Body elongate, robust. Length, ·74 mm. ($\frac{1}{34}$th of an inch). Anterior antennæ short, stout, eight-jointed. The first to the fifth joints gradually decrease in length, the fifth and sixth are about equal, while the sixth to the eighth gradually increase in length; the fourth bears a long and moderately stout sensory filament. The annexed formula shows the proportional lengths of all the joints :—

$$\frac{16 \cdot 14 \cdot 11 \cdot 7 \cdot 6 \cdot 6 \cdot 8 \cdot 10 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot}$$

Posterior antennæ comparatively large, two-jointed. Secondary branch small, one-jointed, and attached to the middle of the basal joint of the primary branch. The mandible-palp consists of a comparatively large basal joint, with a much smaller secondary one at its apex. The secondary joint bears one marginal and a few apical setæ. Posterior foot-jaws stout, the second joint somewhat gibbous below, and armed with a comparatively long terminal claw (fig. 30, pl. V.). The first pair of swimming-feet somewhat similar to those of *Ameira reflexa*, but much stouter and more elongate. In the fourth pair the inner branches are proportionally much shorter than in that species, as they scarcely reach to the end of the second joint of the outer branches. The first joint is very short, while the second and third are each rather longer than the preceding one. The armature of the fourth pair is different from that of the fourth pair in *Ameira reflexa* (fig. 5, pl. VI.). In the fifth pair the basal joint is broadly triangular, and bears two stout spiniform setæ on the distal half of the inner margin, and two apical setæ; one of them small, the other very long, plumose, and spiniform. The secondary branch is elongate, narrow, cylindrical, being nearly five times longer than broad. Both margins are more or less ciliate. The apex is obliquely truncate, and bears several setæ (fig. 31, pl. V.). Caudal stylets very short.

Habitat.—Off St Monance. Scarce.

Remarks.—This is a robust species, with comparatively elongate swimming-feet. It is readily distinguished by the peculiar form of the fifth pair of thoracic feet.

Ameira longiremis, var. *intermedia*, nov. var. (Pl. VI. figs. 6–14.)

This form differs from the species just described, and of which it appears to be a variety, and the more important of these differences are as follows:—The anterior antennæ are shorter and less robust, and the proportional lengths of the joints are not the same, as shown by the formula:—

$$\frac{10 \cdot 14 \cdot 8 \cdot 6 \cdot 5 \cdot 6 \cdot 6 \cdot 6 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot}$$

The last joint of the inner branches of the first thoracic feet is considerably shorter, and the spine that springs from the inner distal angle of the second basal joint is much longer than in the first pair of *Ameira longiremis*. The basal joint of the fifth pair is narrower at the proximal end, and more produced; and the secondary branch is rather broader, and less cylindrical in form. These various differences, though scarcely marked enough to be of specific value, are yet sufficiently important to constitute a varietal difference.

Ameira exilis, T. and A. Scott. (Pl. IX. fig. 30; Pl. X. figs. 1–12.)

1894. *Ameira exilis*, T. and A. Scott, p. 139, pl. viii. figs. 18–20; pl. ix. figs. 1–3.

Description.—Female. Length, 1·4 mm. ($\frac{1}{18}$th of an inch). Body elongate, slender. Anterior antennæ slender, nine-jointed. The seventh and eighth joints very small, the others of moderate length, as shown by the formula:—

$$\frac{13 \cdot 18 \cdot 13 \cdot 10 \cdot 8 \cdot 9 \cdot 3 \cdot 3 \cdot 12 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot}$$

Posterior antennæ short, two-jointed. Secondary branch small, one-jointed, and furnished with three terminal plumose setæ. Mandibles elongate, narrow. Apex obliquely truncate, armed with a large tooth in the middle and several small ones on each side. The basal joint of the mandible-palp is considerably dilated, with the proximal end forming a narrow stalk-like attachment to the base of the mandible; while the distal margin bears three short setæ. The secondary joint, or branch, of the palp is narrow, and about three times longer than broad, with a small marginal and four apical setæ. Posterior foot-jaws robust, and armed with a strong terminal claw (fig. 6). The first pair of swimming-feet are elongate and slender. The first joint of the inner branches, which is furnished with a plumose seta on the lower half of the inner margin, is rather longer than the second and third together. The second joint is little more than half the length of the third, and bears a small plumose seta on its inner distal angle. The outer branches, which are composed of three sub-equal joints, extend very little beyond the first joint of the inner branches. The inner branches of the next three pairs are short, and only extend to about the middle of the second joint of the elongate outer branches. The basal joint of the fifth pair is broadly triangular, and furnished with five terminal setæ; the second one of which, counting from the outside, is very long, being more than double the length of the seta on either side of it. The secondary joint is oblong-ovate in shape, its greatest breadth being equal to about two-fifths of the length, and there are five setæ of variable lengths ranged at intervals from the middle of the outer margin to the apex, in addition to a very long intero-sub-apical seta. The apex of the

basal joint reaches to about the middle of the secondary one (fig. 10). Caudal stylets shorter than the last abdominal segment, and broadly pyriform. The principal tail setæ are as long as the abdomen.

Male.—Anterior antennæ ten-jointed. The fourth joint is narrower than the one that precedes or follows, and is hinged to the fifth; the sixth, and seventh, are very short, and the joints between the eighth and ninth, and between the ninth and tenth segments, appear to be hinged so that each antenna forms a powerful grasping organ (fig. 3). The inner branches of the third pair extend to the end of the second joint of the outer branches, and is furnished, in addition to the plumose marginal setæ, with a terminal spine-like appendage (fig. 9). The form of the fifth pair is somewhat similar to those of the female, but smaller, and without the very long seta on each of the basal and secondary joints. The sixth pair of appendages are very broad and short, in form somewhat like the segment of a circle, and furnished with one long and two short setæ.

Habitat.—At Seafield near Leith. Obtained by washing some black sandy mud near low-water mark.

Remarks.—This large and fine species is readily distinguished from any other British *Ameira* by the pyriform caudal stylets; and, on dissection, by the other characters referred to in the description.

Ameira exigua,* sp. n. (Pl. VI. figs. 15, 23.)

Description.—Female. Length, ·47 mm. ($\frac{1}{53}$rd of an inch). Rostrum prominent. Anterior antennæ sparingly setiferous, rather slender, and eight-jointed. The second joint is longer, and the penultimate one shorter than any of the other joints. The proportional lengths of the joints are nearly as shown by the annexed formula :—

$$\frac{13 \cdot 16 \cdot 10 \cdot 7 \cdot 6 \cdot 6 \cdot 3 \cdot 6 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot}$$

Posterior antennæ and mouth organs nearly as in *Ameira reflexa*. The first pair are moderately stout. The inner branches are of considerable length, but the outer branches are short, and do not reach the end of the first joint of the inner branches. The second joint of the inner branches is small, while the end joint is elongate and slender; but the second and third joints together are scarcely equal in length to the first joint (fig. 20). In the fourth pair the outer branches are long, and inner branches short; the inner branches scarcely extend beyond the end of the second joint of the outer branches (fig. 21). The fifth pair are foliaceous, small. The produced inner portion of the basal joint is broadly sub-conical, and furnished with five terminal and sub-terminal setæ; the second one, from the outside, is considerably longer than any of the others. The secondary joint is broadly ovate, and extends halfway beyond the end of the basal joint, and bears several setæ of unequal length round the outer margin and apex, but the inner margin is ciliated (fig. 22). Caudal stylets shorter than the last abdominal segment, and about as long as broad. The principal seta of each stylet is stout, and longer than the abdomen (fig. 23).

Habitat.—Off St Monans. Not very common.

Remarks.—This very small but distinct species somewhat resembles *Ameira exilis* and *Ameira longipes*, Boeck. It differs from one in being not only much smaller and comparatively more robust, and in the anterior antennæ being eight instead of nine-jointed, but also in the form of the mandible-palp and the structure of the fourth pair of swimming-feet, and from the other by the structure of the mandible-palp and the fifth pair of feet.

* Exiguus = small.

Boeck, in the same year (1864)* in which he instituted the genera *Stenhelia* and *Ameira*, established a third genus, *Nitokra*, all three being closely allied to each other. Species belonging to the first two genera, but apparently none belonging to the last, have been recorded from the British seas; at least I do not know of any record of a British *Nitokra*. In 1891 Dr W. Giesbrecht described† two new species of *Nitokra* that he had discovered amongst sea-weed in the estuary at Keil; and in doing so he drew attention to the more important characters by which these three genera may be distinguished from each other. The characters are these :—

For *Stenhelia*, Boeck.—'Secondary branch of the posterior antennæ 'three-jointed. Mandible-palp with a distinct basal part, bearing 'two separate branches.

For *Ameira*, Boeck.—'Secondary branch of the posterior antennæ 'one-jointed. Mandible-palp one-jointed.'

For *Nitochra*, Boeck.—'Secondary branch of the posterior antennæ 'one-jointed. Mandible-palp two-jointed.'

If these definitions are to be considered satisfactory, the *Ameira longipes*, Boeck, as described and figured in the 'Monograph of the British 'Copepoda,' is a *Nitokra*, as the figure of the mandible-palp exhibits two distinct joints or branches; and probably, also, are all the species described here as *Ameira*. The subject evidently requires further study, so far as the British *Stenheliinæ* are concerned; and meantime I prefer to adhere to the generic definition of *Ameira* in the 'Monogragh of the British Cope-'poda.'

Genus *Delavalia*, Brady (1868).

Delavalia reflexa, Brady and Robertson.

1875. *Delavalia reflexa*, Brady and Robertson (10), p. 196.

One or two specimens of this species were obtained among material dredged off Burntisland in November last year. Several other interesting species have been discovered here, one or two of which are described in the sequel.

Genus *Tetragoniceps*, Brady (1880).

(?) *Tetragoniceps consimilis*,‡ sp. n. (Pl. VII. figs. 4–12.)

Description.—Female. Length, ·85 mm. ($\frac{1}{30}$th of an inch). In general appearance very like *Tetragoniceps bradyi*, T. Scott. Rostrum prominent. Anterior antennæ slender, sparingly setiferous, and eight-jointed. The length of the first joint is at least equal to the combined length of the next three, and it bears a few small but distinct blunt pointed teeth on the upper margin. The upper distal angle of the second joint is produced forward into a prominent tooth (fig. 4). The formula shows the proportional lengths of the joints :—

$$\frac{28 \cdot 12 \cdot 7 \cdot 8 \cdot 4 \cdot 4 \cdot 4 \cdot 6 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot}$$

Posterior antennæ elongate, slender, three-jointed; the last joint is nearly as long as the other two together. A rudimentary secondary branch, furnished with a single apical seta, springs from the end of the first joint. The mandibles have the truncate biting part armed with several elongate

* Oversigt, Norges Kyster, Copepoder, *Calanid. Cyclopid. og Harpactid.* (Christ.), 64.

† Die freilebenden Copepoden der Kieler Föhrde.

‡ Consimilis = very like.

sharp-pointed teeth, decreasing in size from the external edge. The basal part of the mandible-palp is comparatively large, becoming dilated outwardly, and bearing a few small marginal hairs. Apical joint elongate, narrow, with two marginal and four terminal setæ; the secondary marginal joint is very small (fig. 7). Posterior foot-jaws slender, the second joint elongate, end joint very small, terminal claw very slender (fig. 8). The first pair of thoracic feet somewhat like those of *Tetragoniceps bradyi*, but the inner branches are three-jointed, the first very long, the last two short. A small seta springs from near the distal end of the inner margin of the inner branches, and the third joint bears two moderately long and somewhat curved setæ at the apex. The outer branches are three-jointed, and do not reach the end of the first joint of the inner branches (fig. 9). Inner branches of the second, third, and fourth pairs short, and two-jointed; outer branches three-jointed, elongate, and slender (fig. 10). Fifth pair two-jointed. Basal joint short, broad, and somewhat produced exteriorly to an angular apex armed with two short spines; while two small setæ spring from the outer margin. Secondary joint very large and foliaceous, sub-quadrate in form, and one and a half times longer than broad, and bearing one small seta near the middle of the inner margin, and three short, stout, spiniform, and two small setæ on the obliquely truncate apex (fig. 11). Caudal stylets comparatively long and narrow, and about equal in length to the last abdominal segment, and furnished with five terminal setæ, two of them being stout and spiniform, the other three slender. One of the spiniform setæ is short, and springs from the outer edge of the stylet; the other is elongate, and forms the third from the outside.

Habitat.—Off St Monans, Firth of Forth. Rather scarce.

Remarks.—This species closely resembles *Tetragoniceps bradyi* in general appearance as well as in a few anatomical details, but there are important differences that may require its removal from the genus in which it is provisionally placed. Two very important differences are observed in the structure of the first and fifth pairs of thoracic feet. In the first pair the inner branches are three-jointed, and the fifth pair are two-branched. These two characters indicate a considerable divergence from the typical *Tetragoniceps*; but I prefer to leave it in that genus in the meantime, pending a further study of the species.

Genus *Laophonte*, Philippi (1840).

Laophonte depressa, sp. n. (Pl. VI. figs. 24–31; Pl. VII. figs. 1–3.)

Description.—Female. Length, ·84 mm. ($\frac{1}{30}$th of an inch). Body elongate, depressed sub-cylindrical. Breadth across the thorax equal to fully one-fourth of the length. The postero-lateral angles of the second, third, and fourth abdominal segments produced and rounded. Rostrum broad, with the apex rounded. Anterior antennæ sparingly setiferous, shorter than the first cephalo-thoracic segment, and composed of seven joints; the third joint is longer than any of the others, the fourth and fifth are small. The proportional lengths of the joints are shown by the formula:—

$$\frac{12 \cdot 11 \cdot 15 \cdot 5 \cdot 4 \cdot 6 \cdot 7 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot}$$

Posterior antennæ robust; the end joint is about equal in length to the preceding one, and bears a few stout slightly curved spines on the distal half of the upper margin and apex. A small secondary branch with four terminal plumose setæ springs from the middle of the first joint (fig. 2, Pl. VII.). Mandibles well-developed. The mandible-palp is comparatively small, and consists of a narrow elongate joint, with one

marginal and one apical plumose hair, and is provided with a nearly obsolete subterminal second joint supporting three plumose setæ (fig. 25, Pl. VI.). The joints of the posterior foot-jaws are comparatively elongate and narrow. The terminal claw is strong, and slightly curved (fig. 26, Pl. VI.). The two-jointed inner branches of the first pair of thoracic feet are stout, and armed with a powerful terminal claw. The outer branches are small and three-jointed, and only extend to about the middle of the elongate first joint of the inner branches (fig. 27, Pl. VI.). The second, third, and fourth pairs are slender. The inner branches are short and two-jointed, with the first joint small. Both branches are furnished with long plumose setæ (fig. 28, Pl. VI.). The structure of the fifth pair is similar to those of *Laophonte thoracica*, Boeck; but the secondary joint is broader, the breadth being equal to about twofifths, of the length, and with the distal half sub-conical in outline (fig. 30 Pl. VI.). Caudal stylets short, about equal to half the length of the last abdominal segment.

Male.—In the male the fourth joint of the anterior antennæ is dilated and sub-rotund. The terminal joints are narrow, and form a claw-like appendage; and, being hinged to the large fourth joint, constitute an efficient grasping organ (fig. 2, Pl. VII.). The third pair of thoracic feet are moderately stout; the inner branches appear to consist of three sub-equal joints that reach to about the end of the second joint of the outer branches. An irregularly-curved spiniform appendage, extending considerably beyond the apex of the last joint, springs from the end of the second joint, as shown in the figure (fig. 29, Pl. VI.). The basal joints of the fifth pair are not produced exteriorly, but the anterior angle is furnished with two plumose setæ. The secondary joint is shorter than that of the female fifth feet, and there is proximally a lobe-like marginal process, furnished with a terminal plumose seta. On the conical end of the secondary joint there are two stout setæ on the inner and two on the outer margin, and an elongate apical seta. The sixth appendage is small, narrow, and provided with three terminal plumose setæ (figs. 31, Pl. VI.).

Habitat.—Off St Monans and also off Musselburgh. Rather scarce.

Remarks.—This species resembles *Laophonte thoracica*, Boeck, in some of its characters, as, for example, in the form of the thoracic feet; but the structure of the anterior antennæ and posterior foot-jaws, and the short caudal stylets, distinguish it at a glance from that species.

Laophonte denticornis, sp. n. (Pl. VII. figs. 13–23.)

Description.—Female. Length, ·86 mm. ($\frac{1}{29}$th of an inch). Body seen from above, slender, sub-cylindrical; the first cephalo-thoracic segment nearly equal to the combined length of the next four. The postero-lateral angles of the second, third, and fourth abdominal segments are slightly produced and rounded; while the third and fourth segments are proximally narrower than they are distally. Forehead sub-triangular. Anterior antennæ six-jointed, stout, sparingly setiferous, and about equal in length to the first cephalo-thoracic segment. The first three joints are of moderate length and sub-equal, the fourth and fifth are small. The second joint is armed on the under side with a stout conical tooth nearly at right angles to the joint (fig. 14). The proportional lengths of the joints are shown by the formula :—

$$\frac{18 \cdot 16 \cdot 15 \cdot 5 \cdot 3 \cdot 11 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot}$$

The fourth joint is produced on the upper side to form the base of a moderately long filament. The basal joint of the posterior antennæ is

somewhat robust, and bears a short plumose seta near the middle of the upper margin. A small secondary joint, furnished with two marginal and two terminal plumose hairs, springs from the middle of the joint nearly opposite the marginal seta. The second joint is about equal in length to the first, but considerably narrower (fig. 16). The mandible-palp is small, narrow, one-jointed, and furnished with a few short plumose hairs (fig. 17). In the posterior foot-jaws the first joint is narrow; the second is considerably dilated, and furnished with a strong hooked claw, scarcely equal in length to the joint from which it springs. The inner branches of the first pair of swimming-feet are elongate and rather slender. The second joint is proportionally much longer than it is in several described species of *Laophonte*, being equal to fully one-third of the length of the first joint. Terminal claw slender, and only slightly curved. The outer branches, which consist of three sub-equal joints, are equal to about half the length of the first joint of the inner branches (fig. 19). The inner two-jointed branches of the fourth pair extend slightly beyond the end of the second joint of the outer branches (fig. 20). The inner portion of the basal joints of the fifth pair is produced into a sub-cylindrical lobe, obliquely rounded at the end, and provided with four plumose setæ arranged at nearly equal distances round the lower half and end of the inner edge. The secondary joints are small and cyclindrical in form, and furnished with five setæ on the irregular edge of the truncate apex (fig. 21). Caudal stylets narrow, and rather longer than the last abdominal segment.

Male.—The tooth on the under side of the second joint of the male anterior antennæ is scarcely so large as in the female. The terminal joints are modified somewhat like those of the male of *Laophonte depressa* (fig. 15). The inner branches of the third pair of thoracic feet are very short, and provided with a strong irregularly-curved spiniform appendage (fig. 21). The inner portion of the basal joints of the fifth pair are not produced, but are slightly bilobed, each lobe bearing a single apical seta. The secondary joints are somewhat similar to those of the female, but rather narrower (fig. 23). The sixth appendage is very small, and furnished with two short hairs.

Habitat.—Off St Monans. Rare.

Remarks.—The slender form of this species, considered in connection with the armature of the anterior antennæ, is alone sufficient to enable it to be distinguished from others of the same genus. It is unlike any other *Laophonte* known to me, except, perhaps, *Laophonte serrata* (Claus).

Laophonte littorale, T. and A. Scott.

1893. *Laophonte littorale*, T. and A. Scott, p. 238, pl. xi. figs. 7–14.

Description.—Female. Length, ·85 mm. ($\frac{1}{30}$th of an inch). Body elongate, sub-cylindrical. Forehead very slightly produced into a bluntly rounded rostrum Anterior antennæ sparingly setiferous, and composed of seven joints; the third joint is longer and the fifth shorter than any of the others. The proportional lengths of all the joints are shown by the formula:—

$$\frac{9 \cdot 10 \cdot 12 \cdot 5 \cdot 3 \cdot 6 \cdot 8 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7.}$$

Secondary branch of posterior antennæ rudimentary, and consisting of one small joint bearing a small apical seta. Mouth organs nearly as in *Laophonte curticauda*, Boeck. Inner branches of the first thoracic feet moderately stout. The second joint is scarcely equal to one-fourth of the length of the first, and the terminal claw is stout and hooked at the apex.

Outer branches slender, three-jointed, and equal to nearly three-fifths the length of the first joint of the inner branches. Inner branches of the second, third, and fourth pairs, short, two-jointed; those of the fourth pair scarcely reach beyond the end of the first joint of the outer branches. The outer branches of the fourth pair are short, stout, and very setose. In the fifth pair both joints are broadly foliaceous and sub-quadrate, and bear a number of strongly plumose terminal setæ. Caudal stylets equal to one and a half times the length of the last abdominal segment, and clothed with minute hairs.

Male.—Anterior antennæ very robust. The three last joints, which together form a claw-like appendage, are joined to the preceding joint by a strong hinge-like process, by which they can be folded back upon that joint, thus forming a powerful grasping organ. The inner branches of the fourth pair of thoracic feet are very rudimentary, and consist of two minute joints; the outer branches are three-jointed and robust. The first joint is considerably longer than the next two together. The first and second joints are each armed with a stout spine at the distal end; while the last joint bears three spines, one small and two large, as shown in the figure. Fifth pair rudimentary, consisting of a slightly produced basal portion carrying four setæ on small basal projections, and a minute spine on the inner margin. The sixth appendage consists of a small bilobed process, each lobe bearing a stout apical seta.

Habitat.—In pools of brackish water at the mouth of a small stream near Aberlady, Firth of Forth; and in similar pools at the mouth of the River Alness, near Invergordon, Cromarty Firth.

Remarks.—This species somewhat resembles *Laophonte curticauda*, Boeck. The outer branches of the male fourth thoracic feet are not very unlike those of the male third pair of that species, but the structure of the inner branches is very different. *Laophonte littorale* appears to be confined to localities where the water is more or less brackish.

(?) *Laophonte simulans*,* sp. n. (Pl. VII. figs. 24–32; Pl. VIII. fig. 1).

Description.—Female. Length ·43 mm. ($\frac{1}{58}$th of an inch). Body seen from above, broadly ovate, depressed. Forehead produced into a broad blunt pointed rostrum. Anterior antennæ robust, shorter than the first cephalo-thoracic segment, six-jointed. The third joint is considerably longer than any of the others, while the fourth and fifth are small; a long slender filament springs from the fourth joint (fig. 1, Pl. VIII.). The proportional lengths of the joints are shown by the formula:—

$$\frac{14 \cdot 18 \cdot 23 \cdot 5 \cdot 3 \cdot 12 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot}$$

Basal joint of posterior antennæ robust. Second joint shorter and much narrower. Secondary branch short, bearing four terminal plumose setæ (fig. 25, Pl. VII.). Mandible elongate, slender, and provided with a small one-jointed palp (fig. 26, Pl. VII.). Posterior foot-jaws stout, armed with a powerful strongly curved terminal claw, rather shorter than the joint from which it springs (fig. 27, Pl. VII.). Inner branches of the first pair of thoracic feet elongate and robust. A small blunt-pointed spine springs from near the distal end of the first joint. The second joint is short, being only equal to about one-fifth of the length of the first joint. Terminal claw stout, and strongly hooked at the end. Outer branches are slender and three-jointed, and about two-thirds the length of the first joint of the inner branches. The second and third pairs are moderately stout, and have the inner branches two and the outer three-jointed,—the inner branches being shorter than the outer (fig. 28, Pl. VII.). In the fourth pair the inner

* Simulans = mimicking.

branches consist of one and the outer of two joints, as shown in the figure (fig. 29, Pl. VII.). The inner portion of the basal joint of the fifth pair is not developed, but looks like a flattened border to the thoracic segment to which it is attached. It is furnished with three marginal setæ; the outer portion projects outwards in the form of an elongate narrow process carrying a slender apical seta. The secondary joint has an obovate form, and is provided with five setæ of variable lengths round the distal end (fig. 30, Pl. VII.). Caudal stylets short, with a considerable space between them. The thoracic and abdominal segments are all fringed more or less with cilia.

Habitat.—Off West Wemyss, Firth of Forth. Rare.

Remarks.—This small and very curious species was discovered within the valves of a dead *Cyprina* shell, accidentally picked out from among some trawl refuse. It seems to combine the form of one of the depressed *Dactylopus* with the anatomical characters of *Laophonte*. It differs, however, from the typical *Laophonte* in the structure of the third pair of swimming-feet, which in this species have the inner branches one and the outer branches two-jointed. It also carries two ovisacs, which is very unusual among the *Laophonte*. It nevertheless agrees in so many particulars with the characters of that genus, that I propose, for the present at least, to place it among the *Laophonte*. *Laophonte simulans* is, so far, one of the smallest of the Forth species belonging to this genus.

Sub-genus *Laophontodes*, nov. sub-gen.

Like *Laophonte*, Philippi, except that the posterior antennæ have no secondary branch, and the fifth pair of thoracic feet are one-jointed. In the second, third, and fourth pairs of thoracic feet the second basal joints are elongate, and the outer branches are articulated to the apex, and the inner branches to the margin, and near the proximal end of the basal joint. The two branches are more widely apart than is usual in the genus *Laophonte*.

Laophontodes typicus, sp. n. (Pl. VIII. figs. 2–8.)

Description.—Female. Length, ·4 mm. ($\frac{1}{62}$nd of an inch). Body seen from above, narrow, elongate; the breadth gradually decreasing towards the posterior end. All the segments more or less angular. The first cephalothoracic segment is nearly quadrangular in outline; the middle part of the front margin is produced to form a broad sub-truncate rostrum. Anterior antennæ short, five-jointed. All the joints are comparatively elongate, except the fourth, which is very small. The formula shows the proportional lengths of the joints:—

$$\frac{5 \cdot 6 \cdot 7 \cdot 1 \cdot 5 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot}$$

Posterior antennæ two-jointed, and of moderate size; no secondary appendage (fig. 4). Posterior foot-jaws small, three-jointed; the end joint very small. Terminal claw slender, slightly curved at the apex (fig. 5). First pair of thoracic feet like those of *Laophonte*. Second joint of the inner branches is scarcely equal to one-third the length of the first joint. Terminal claw slender, strongly hooked at the end. A small seta springs from the base of the claw. Outer branches three-jointed; the first and second joints sub-equal, the third shorter, the entire outer branch is equal to fully half the length of the first joint of the inner branch (fig. 6). Inner branches of the second, third, and fourth pairs short, two-jointed, and articulated to the second basal joint near its proximal end. The first joint of the inner branches is very small, the other is elongate. Outer branches

elongate, three-jointed, and articulated to end of the elongate, narrow, second basal joint; the outer and inner branches being thus widely apart (fig. 7). Fifth pair one-branched, narrow, elongate, and furnished with one seta near the middle of the inner margin, three on the outer margin, and three at the apex (fig. 8). Caudal stylets long and narrow, being equal to one and a half times the length of the last abdominal segment, and each furnished with a stout apical seta and a few minute hairs.

Habitat.—Vicinity of Inchkeith. Rare.

Remarks.—This curious species was dredged at the north end of the Island of Inchkeith. Very few specimens were obtained.

Genus *Normanella*, Brady (1880).

Normanella dubia (Brady and Robertson).

1875. *Laophonte dubia*, Brady and Robertson (10), p. 196.
1880. *Normanella dubia*, Brady (8), vol. ii. p. 87, pl. lxxviii. figs. 12–22.
1893. *Normanella dubia*, I. C. Thompson (33), p. 26, pl. xxi. fig. 6.

Habitat.—Off Musselburgh. Not very scarce, but easily overlooked. *Normanella dubia* seems to be widely distributed in the British seas.

Genus *Cletodes*, Brady (1872).

Cletodes irrasa, T. and A. Scott.

1894. *Cletodes irrasa*, T. and A. Scott (31), p. 141, pl. viii. figs. 8–12.

Description.—Female. Length, ·8 mm. ($\frac{1}{30}$th of an inch). Body elongate, cylindrical. All the segments, except the first, furnished with a fringe of small hairs around, but a little in front of, the posterior margin. Anterior antennæ stout, shorter than the first body segment, and composed of six joints; the second and last joints are longer than any of the others, the fifth is very small. The proportional lengths of all the joints are shown by the formula :—

$$\frac{20 \cdot 26 \cdot 20 \cdot 10 \cdot 3 \cdot 24 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot}$$

Posterior antennæ three-jointed. A small secondary branch bearing a single apical seta springs from the end of the first joint. Inner branches of the first pair of thoracic feet, which are composed of two sub-equal joints, reach to about the middle of the second joint of the outer branches, and bear two short apical setæ. Inner branches of the fourth pair, which are also two-jointed, shorter than the first joint of the elongate outer branches. The inner portion of the basal joint of the fifth pair is in the form of a shallow lobe, carrying two long and one short seta. Secondary joint narrow and elongate, and furnished with one marginal and four terminal setæ. Caudal stylets slender, equal in length to the last abdominal segment, each with two small setæ on the inner and one on the outer margin, and a few apical setæ.

Habitat.—Vicinity of the Bass Rock. Rather rare.

Cletodes curvirostris,* sp. n. (Pl. VIII. figs. 18–26.)

Description.—Female. Length, ·9 mm. ($\frac{1}{28}$th of an inch). Body subcylindrical, usually arcuate when seen from the side. Rostrum short, stout recurved. Anterior antennæ robust, short, and composed of six joints. The third is considerably larger and the fifth smaller than any of the other

* Referring to the recurved rostrum.

joints, as shown by the annexed formula, which indicates approximately the proportional lengths of all the joints :—

$$\frac{7 \cdot 7 \cdot 11 \cdot 4 \cdot 2 \cdot 8 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot}$$

Posterior short and stout. Secondary appendage represented by a single small plain seta which springs from near the middle of the first joint. A small plumose seta springs from exterior margin of the same joint (fig. 20). Mandibles armed with a number of spiniform teeth, the middle one being larger than the others. Palp small, one-jointed, provided with one marginal and two terminal plumose setæ ; and a peculiar appendage, bifid at the apex, springs from a small marginal lobe (fig. 21). Posterior foot-jaws very small, with a slender terminal claw. The inner branches of the first pair of swimming-feet are composed of two nearly equal joints, the second one being only slightly longer than the other. The inner branches are about two-thirds of the length of the outer three-jointed branches. A stout setose spine springs from the inner distal angle of the second basal joint (fig. 22). Inner branches of the fourth pair small, scarcely equal in length of the first joint of the outer three-jointed branches, and composed of two joints, the first joint shorter than the other. All the swimming-feet are short and stout. Basal joints of the fifth pair small ; the produced interior portion is rather short and narrow, and provided with three stout setæ—one marginal and two terminal. A slender seta, articulated near the middle, springs from the exterior angle. Secondary joints elongate, narrow, sub-cylindrical, bearing a stout terminal seta and two smaller marginal setæ, all three being plumose (fig. 25). Caudal stylets moderately stout, rather longer than the last adominal segment. Each stylet is furnished with a small seta near the middle of the outer margin in addition to a few terminal setæ.

Habitat.—Largo Bay. Not unfrequent.

Remarks.—This species resembles *Enhydrosoma curvata* in general appearance, but in structural details it is clearly a *Cletodes*.

* Genus *Pontopolites*, nov. gen.

Animal somewhat resembling *Dactylopus* in general form. Anterior antennæ five-jointed ; shorter than the first body segment. Posterior antennæ like those of *Cletodes*, but the secondary branch is two-jointed. Mandible-palp small ; composed of a distinct basal part and two small one-jointed branches, the posterior one being rudimentary, or nearly so. Maxillæ and anterior and posterior foot-jaws as in *Cletodes*. First pair of swimming-feet somewhat similar to those of *Attheyella pygmæa* (G. O. Sars) (= *Attheyella cryptorum*, Brady). The inner branches, which are composed of two nearly equal joints, are of about the same length as the outer three-jointed branches (fig. 14, Pl. IV.). The inner branches of the second, third, and fourth pairs consist of a single and more or less rudimentary joint. The fifth pair are one-branched. One ovisac.

Pontopolites typicus, sp. nov. (Pl. VIII. figs. 9–17.)

Description.—Female. Length, ·6 mm. ($\frac{1}{42}$nd of an inch). Body elongate, sub-cylindrical. Rostrum short, subtriangular, with the apex bluntly rounded. A minute seta springs from a small notch on each side of the apex. Anterior antennæ short, stout, five-jointed, the fourth joint very small. The proportional lengths of the joints are shown by the formula :—

$$\frac{16 \cdot 12 \cdot 14 \cdot 4 \cdot 15 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot}$$

The small two-jointed secondary branch of the posterior antennæ springs

* Ποντος, the sea ; Πολιτης, a citizen.

from near the base of the first joint (fig. 11). The basal part of the mandible-palp bears two spinulose setæ at the apex. The primary branch is furnished with one marginal and three terminal setæ, while the secondary branch consists of a small papilla bearing a single small hair. Posterior foot-jaws short, stout, two-jointed, and armed with a moderately long terminal claw. First pair of swimming-feet short, moderately stout; both branches of nearly equal length; the inner branches composed of two, the outer of three sub-equal joints (fig. 14). The first pair closely resemble those of *Attheyella pygmæa* (G. O. Sars). Inner branches of second, third, and fourth pairs small, one-jointed. Those of the fourth pair rudimentary, and bearing a short terminal spine. Outer branches elongate, the third joint being nearly equal to the combined length of the other two (fig. 15). The fifth pair consist each of a single joint (or branch), sub-quadrangular in form, but rather longer than broad, and extends obliquely outwards from its attachment to the fifth thoracic segment. A number of long stout plumose setæ fringe the oblique exterior margin, while a few plain setæ spring from the truncate apex, as shown in the figure (fig. 16). Caudal stylets very short.

Habitat.—Off Musselburgh. Not common.

Genus *Heteropsyllus*,* nov. gen.

Body sub-cylindrical. Anterior antennæ shorter than the first body segment, and composed of five joints. Posterior antennæ like those of *Cletodes*, but the secondary branch consists of two joints. Mandible-palp small, with a distinct basal part bearing two small branches. Mouth organs as in *Pontopolites*. Both branches of the first pair of swimming-feet three-jointed, the inner being rather longer than the outer branches. Inner branches of the second, third, and fourth pairs two-jointed, and considerably shorter than the elongate three-jointed outer branches. Fifth pair two-branched. Foliaceous. One ovisac.

Heteropsyllus curticaudatus, sp. n. (Pl. VIII. figs. 27–34; Pl. IX. fig. 1.)

Description.—Female. Length, ·5 mm. ($\frac{1}{50}$th of an inch). Body elongate, sub-cylindrical. Forehead produced into a short rostrum (fig. 27, Pl. VIII.). Anterior antennæ stout, shorter than the first cephalo-thoracic segment, and composed of five joints, the fourth being very short. The approximate proportional lengths of the joints are shown by the formula:—

$$\frac{10 \cdot 9 \cdot 7 \cdot 3 \cdot 14 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot}$$

The two-jointed secondary branch of the posterior antennæ is furnished with four small setæ,—one at the end of the first joint, a marginal and two terminal setæ on the second joint (fig. 29, Pl. VIII.). Mandible-palp small, but distinctly two-branched (fig. 30, Pl. VIII.). Posterior foot-jaws small, and in form somewhat similar to those of the species last described. Both branches of the first pair of swimming-feet composed of three sub-equal joints, the inner rather longer than the outer branches (fig. 32, Pl. VIII.). Outer branches of the second, third, and fourth pairs elongate and three-jointed, somewhat slender. The third joint of all the outer branches is longer than either the first or second joints. Inner branches shorter than the outer, and two-jointed; those of the fourth pair scarcely longer than the first joint of the outer branches (fig. 33, Pl. VIII.). The basal joints of the fifth pair are large, broadly but somewhat obliquely rounded at the distal end, and provided with five terminal setæ ranged at more or less equal distances from each other round the apex and lower inner margin.

* Ἕτερος, different; ψυλλος, a flea.

The seta on the outside is plain, the others are plumose. Secondary joints small, sub-cylindrical, scarcely extending beyond the end of the basal joints. Bordering upon the concave exterior margin of the basal joints, and near the proximal end of the secondary joints, there is a clearly defined lucid space of a somewhat semi-circular outline (fig. 1, Pl. V.). Caudal stylets very short, the breadth about equal to the lengths. The stylets, being comparatively narrow, are widely apart; and as the last abdominal segment, as seen from the side, ends abruptly, the stylets, though short, are quite prominent (see figs. 27 and 34, Pl. VIII.).

Habitat.—Off Musselburgh and off Aberdour. Frequent.

Remarks.—This is a well-marked species. When mixed up with other forms it is readily distinguished by the abrupt junction of the stylets to the last abdominal segment. Though moderately frequent, both in material dredged off Musselburgh and Aberdour, no males have yet been obtained.

Genus *Nannopus*, Brady (1880).

Nannopus palustris, Brady.

1880. *Nannopus palustris*, Brady (8), vol. ii. p. 101, pl. lxxvii. figs. 18–20.

1892. *Nannopus palustris*, Canu (11), p. 166, pl. iv. figs. 6–21.

Habitat.—In pools near the mouth of Cocklemill Burn—a small stream that enters the Forth at the east end of Largo Bay. The mouth of this stream is comparatively narrow, but immediately beyond the outlet there is a large expanse of low-lying ground intersected by numerous furrows or ditches branching off from the main channel of the stream; a considerable portion of this low-lying ground is covered by the sea at high-water, and especially during spring tides. This tidal lagoon, as it may be called, appears to harbour a peculiar and interesting micro-fauna, which has not hitherto been very carefully worked up. Some material was collected here by hand-net in August 1890, but it was not till a few months ago that there was sufficient leisure to attend to it. It was then ascertained that this curious species was not unfrequent in the material. *Nannopus palustris* was discovered by Dr Brady, also, in brackish-water pools, at Seaton Sluice, Northumberland, where only a few specimens were obtained. Dr Eugene Canu records this species also from Wimereaux, France, where it also occurs in somewhat similar conditions to those described above. The rudimentary structure of the inner branches of the third and fourth pairs of feet appear to be characteristic of the species.

Genus *Leptopsyllus*,* nov. gen.

Body elongate, cylindrical, somewhat similar in form to *Cylindropsyllus*, Brady. Anterior antennæ eight-jointed, short. Posterior antennæ three-jointed; secondary branch small, one-jointed. Mandibles well-developed, the broad biting part armed with several strong teeth. Palp comparatively large, consisting of a moderately stout basal joint, and a single two-jointed branch. Other mouth appendages nearly as in *Cletodes*, except that the posterior foot-jaws are three-jointed. Both branches of the first pair of swimming-feet short and two-jointed. In the second and third pairs the inner branches are obsolete or entirely absent, but the outer branches are three-jointed. Inner branches of the fourth pair two-jointed; outer branches three-jointed. Fifth pair foliaceous, small, two-branched.

* Λεπτος, slender; and ψυλλος, a flea.

Leptopsyllus typicus, sp. n. (Pl. IX. figs. 2–11.)

Description.—Female. Length, ·74 mm. ($\frac{1}{34}$th of an inch). Anterior antennæ eight-jointed, short and robust; the fifth, sixth, and seventh joints are shorter than any of the others. The formula shows the proportional lengths of the joints:—

$$\frac{13 \cdot 10 \cdot 6 \cdot 3 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot}$$

Posterior antennæ composed of three moderately long joints; and the small one-jointed secondary branch springs from near the end of the first joint (fig. 4). The two-jointed branch of the mandible-palp has the first joint elongate, and furnished with a marginal second joint, very short, and provided with three terminal hairs (fig. 5). Maxillæ as in *Cylindropsyllus*. Anterior foot-jaws stout, two (or three) jointed, furnished with three marginal processes, each with two small spinulose terminal setæ; the distal end of the second joint is produced, and supports a stout curved spine. In a notch near the distal end of the second joint there is what looks like a rudimentary third joint, from which spring three small setæ (fig. 6). Posterior foot-jaws slender, three-jointed, the end joint small. The terminal claw is very long and slender, and is accompanied by a spiniform seta nearly equal to half the length of the claw (fig 7). Both branches of the first pair of swimming-feet are short and two-jointed, and somewhat widely apart; the second joint is rather shorter than the first in both branches (fig. 8). The second and third pairs are only one-branched, the inner branches being apparently entirely absent. Each branch consists of three joints, the middle one being shorter than the one on either side. The first two joints are each armed with a moderately stout slightly curved spine on the outer distal angles, while the last joint carries two terminal spines (fig. 9). In the fourth pair the inner branches are slender and two-jointed. The end joint is small, and provided with a moderately stout terminal spine. The outer branches are three-jointed. The joints are sub-equal, and armed similar to those of the second and third pairs (fig. 10). Fifth pair small and foliaceous. Each consists of a basal and a secondary joint. The inner portion is produced into a sub-cylindrical lobe, rounded at the end, and bearing two terminal hairs. The outer portion is also produced, but not so much as the inner portion, and bears one hair. The small secondary joint is situated in the hollow between the two produced portions of the basal joint, and is furnished with three terminal hairs (fig. 11). Caudal stylets elongate, and each composed of two distinct joints. The first joint is about one and a half times the length of the last abdominal segment, and about three times longer than broad, and has the inner distal angle produced into a blunt-pointed tooth-like process. The second joint (or appendage to the stylets) is of an elongate oval form, and equal to about one-third the length of the first joint to which it is attached by a narrow hinge-like articulation.

Habitat.—West of Queensferry. Washed from lumps of hardened mud composed of the agglutinated tubes of a species of *Sabella*. Rare. No males have yet been observed.

Genus *Dactylopus*, Claus (1863).

Dactylopus stromii (Baird).

1850. *Canthocamptus stromii*, Baird (2), p. 208, pl. xxvii. fig. 3.
1880. *Dactylopus stromii*, Brady (8), p. 3, pl. lv. figs. 1–13.
1892. *Dactylopus stromii*, Canu (11), p. 159.
1893. *Dactylopus stromii*, I. C. Thompson (33), p. 27, pl. xxii. fig. 4 *a*, *b*.

Habitat.—Off Limekilns, west of Queensferry. Washed from lumps of hardened mud. Not very common.

This species appears to be extensively distributed throughout the British Islands.

Dactylopus coronatus, sp. n. (Pl. IX. figs. 12–20.)

Description.—Female. Length, ·57 mm. ($\frac{1}{44}$th of an inch). Body moderately robust. Anterior antennæ short, stout, six-jointed, and bearing numerous elongate and stout, plain, and spinulose setæ (fig. 13). The ante-penultimate joint is rather shorter than any of the others, and bears a long stout filament. The formula shows the proportionate lengths of the joints:—

$$\frac{13 \cdot 17 \cdot 12 \cdot 8 \cdot 11 \cdot 10 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot}$$

Posterior antennæ short and stout. Secondary branch two-jointed, strongly setiferous. Mandibles somewhat like those of *Dactylopus tisboides*, Claus. The biting part is armed with a broad trifid tooth, two spiniform teeth, and a few setiferous spines (fig. 15). Posterior foot-jaws robust. A strong setiferous spine springs from the inner distal angle of the first joint. Terminal claw stout, curved, scarcely equal in length to the joint from which it springs. Both joints are furnished with rows of cilia, as shown in the figure (fig. 16). All the swimming-feet are short and stout, but those of the first pair are more robust than the others. The first joint of the inner branches of the first pair is considerably dilated, and longer than the next two together, and furnished with a plumose seta near the middle of the inner margins. The second and third joints are sub-equal, and much narrower than the first joint. The second joint bears a seta similar to that of the first joint. The third joint bears a small marginal plumose seta, a terminal plumose seta, and two elongate curved terminal spines. The outer branches are nearly equal to the length of the first two joints of the inner branches. The first two joints are sub-equal, but the last is only about two-thirds the length of the preceding one (fig. 17). The middle joint of the outer branches is furnished with a long plumose seta near the end of the inner margin. The spines on the outer margins of the first and second joints are moderately stout and setiferous. The outer one of the five terminal spiniform setæ is about the same length as the marginal spines, but the others become gradually more elongate, so that the inner one is fully three times the length of the outer (fig. 17). The inner branches of the second, third, and fourth pairs are shorter than the outer branches, and both are furnished with several plumose setæ on the inner margins, while the outer margins are strongly ciliate. The marginal spines of the outer branches are all more or less setiferous (fig. 18). The fifth pair are each indistinctly two-branched (or two-jointed) and foliaceous. The joints are sub-equal, and are each furnished with five stout plumose setæ of various lengths round the distal end. Caudal stylets short. One ovisac.

Habitat.—Among dredged material from the Rath ground in the vicinity of the Bass Rock; also in dredged material from Largo Bay. Not common.

Remarks.—The structure and armature of the anterior antennæ are alone sufficient to distinguish this from other species of *Dactylopus*.

Genus *Thalestris*, Claus (1863).

Thalestris forficuloides, T. and A. Scott. (Pl. X. figs. 13–25.)

1894. *Thalestris forficuloides*, T. and A. Scott (31), p. 142, pl. ix. figs. 4–9.

Description.—Female. Length, 73 mm. ($\frac{1}{34}$th of an inch). Anterior

antennæ nine-jointed, and bearing long slender setæ. The proportional lengths of the joints are shown in the formula :—

$$\frac{15 \cdot 18 \cdot 13 \cdot 10 \cdot 8 \cdot 11 \cdot 6 \cdot 5 \cdot 11 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot}$$

The secondary branches are composed of two moderately long joints. Mandibles with the oblique biting edge coarsely serrate. Mandible-palp with a moderately large, stout, basal part, and two small branches (fig. 16). Maxilla-palp with three small narrow branches, each bearing two to three slender apical setæ (fig. 17). Posterior foot-jaws short, moderately stout; the last joint somewhat ovate, bearing a slender seta near the middle of the inner margin. Terminal claw slender, gently curved (fig. 19). The first pair of swimming-feet slender. Inner branches considerably longer than the outer. The inner terminal claw of both branches is comparatively very long and slender (fig. 20). In the fourth pair the inner branches reach slightly beyond the second joint of the outer branches. The last joint of the inner branches is about equal to three-fourths of the entire length of the other two joints, and the length of the last joint of the outer branches is nearly equal to that of the first and second together (fig. 21). The basal joints of the fifth pair are broadly triangular, and the apex reaches to near the middle of the secondary joints. They are furnished with three plumose setæ on the inner distal margin, and a moderately long terminal and small sub-terminal setæ. Secondary joints sub-cylindrical, and bearing eight setæ,—three on the inner and three on the outer distal margin, and two at the apex. Both margins of both joints are fringed with cilia (fig. 23). Caudal stylets very short. All the body segments are fringed with cilia round the posterior margin.

Male.—Anterior antennæ apparently eight-jointed, hinged between the second and third and between the fifth and sixth. The first three joints are sub-equal, and the fifth and last are about equal in length to that of the first three, but are narrower; while the fourth and seventh are smaller than those that preceed or follow. The inner branches of the third pair in the male are provided with an elongate spiniform appendage, slightly hooked at the end (fig. 22). The basal joint of the fifth pair is furnished with only two small spiniform setæ. The secondary branch is somewhat like that of the female, but rather smaller.

Habitat.—At Seafield, near Leith, among mud near low-water mark. This species resembles *Thalestris forficula*, Claus, but differs in several important particulars,—it differs in the proportional lengths of the joints of nine-jointed anterior antennæ; it also differs in the structure of the swimming-feet, as shown by the description and figures.

Genus *Pseudowestwoodia*, nov. gen.

Very like *Westwoodia* in general appearance when seen from the side. Anterior antennæ six or seven-jointed. Secondary branch of posterior antennæ small, one-jointed. Mouth appendages similar to those of *Westwoodia*. Both branches of first pair of swimming-feet two-jointed, but in general appearance the first pair resemble those of *Westwoodia*. The other thoracic appendages are similar in structure to those of that genus. The distinctive characters of *Pseudowestwoodia* are the one-jointed secondary branch of the posterior antennæ, and the first pair of swimming-feet with both branches two-jointed. All the other characters are more or less similar to those of *Westwoodia*, hence the proposed generic name for the form now under consideration.

Considering the many points of resemblance between the characters of the species now to be described and those of the genus *Westwoodia*, a

strong desire was felt to include it in that genus; but it was clearly perceived that in order to do so a considerable modification of the definition of that genus would be necessary. In *Westwoodia* the secondary branch of the posterior antennæ is *two-jointed*, and the first pair of swimming-feet have the inner branches *three* and the outer only *one-jointed*.

Pseudowestwoodia andrewi,* sp. n. (Pl. IX. figs. 21–29.)

Description.—Female, ·46 mm. ($\frac{1}{54}$th of an inch). Body similar to *Westwoodia nobilis* (Baird) in general appearance, but smaller. Anterior antennæ six-jointed, slender, and sparingly setiferous The first three and last joints are elongate, while the fifth is smaller than any of the others. The proportional lengths of the joints are as follows :—

$$\frac{9 \cdot 11 \cdot 11 \cdot 6 \cdot 4 \cdot 12 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot}$$

The posterior antennæ consist of two sub-equal joints. The small one-jointed secondary branch springs from near the middle of the first joint (fig. 23). Mandible-palp with a moderately large basal joint bearing two small one-jointed apical branches, each branch furnished with several slender setæ (fig. 24). Posterior foot-jaws moderately stout. Terminal claw slender, rather longer than the joint from which it springs. The first joint bears a small seta near its inner distal angle, and a similar seta springs from about the middle of the inner margin of the second joint (fig. 25). The outer branches of the first pair of swimming-feet are about equal to half the entire length of the inner branches, and composed of two sub-equal joints. The first joint is armed with a stout spine at the outer distal angle, while the second joint bears a similar spine near the middle of the outer margin. One small seta near the lower part of the inner margin, and two spiniform setæ at the apex. The first joint of the inner branches is moderately stout and elongate, and becomes narrower towards the distal end. A long plumose seta springs from the inner margin at about one-third of the length of the joint from the proximal end. The second is small and narrow, and only equal to about one-fourth of the length of the first joint, and furnished with two slender, moderately elongate and spiniform apical setæ. A stout spine springs from both the inner and outer distal angles of the second basal joints (fig. 26). The second, third, and fourth pairs are nearly as in *Westwoodia nobilis* (Baird). The fifth pair are small and foliaceous. The length of the produced inner portion of the basal joint is scarcely equal to the breadth of the proximal end. Distal end broadly truncate, and furnished with four spiniform setæ and a short moderately stout spine—the spine being at the exterior angle. Secondary joints small, extending little beyond the end of the produced inner portion of the basal joints; sub-quadrangular in form, and armed with three short but strong dagger-shaped spines on the somewhat obliquely truncate end, and a small spine and a spiniform seta on the distal part of the inner margin (fig. 28). Caudal stylets very short. A short stout spine springs from the outer distal angle of each stylet, and the inner of the two principal tail setæ is about one-third longer than the other.

Habitat.—Off Burntisland. Frequent. Among material dredged in three or four fathoms water.

Remarks.—This small but interesting species is readily distinguished from others, even without dissection, when examined under the microscope, by the peculiar armature of the fifth pair of thoracic feet. It seems to have affinities with *Westwoodia* on the one hand and with *Harpacticus* on the other, and forms a connecting-link between them.

* The species is so named in compliment to my son, Andrew Scott, to whose painstaking and ever-ready assistance and facile pencil I owe so much of my success among the *Copepoda*.

A second species of *Pseudowestwoodia* has lately been discovered in material from Cromarty Firth. It differs from that now described in the structure of the anterior antennæ, and in the armature and form of the first and fifth feet. This species is to be described later on.

Family Lichomolgidæ.

Genus *Pseudanthessius*, Claus (1889).

[*Lichomolgus*, Thorell (Pars) 1859].

Pseudanthessius liber (Brady and Robertson).

1875. *Lichomolgus liber*, Brady and Robertson (10), p. 197.
1880. *Lichomolgus liber*, Brady (8), vol. iii. p. 44, pl. lxxxvi. figs. 1–13.
1893. *Lichomolgus liber*, I. C. Thompson (33), p. 33, pl. xxv. figs. 2 *a*, *b*.

Habitat.—Vicinity of Inchkeith (north end). Scarce.

As has been pointed out by Dr Canu (*Les Copepodes du Boulonnais*, p. 241), one of the principal characters by which *Pseudanthessius*, Claus, is distinguished from *Lichomolgus* proper, is the structure of the fourth pair of thoracic feet, the inner branches of which, in *Pseudanthessius*, are only one-jointed, and furnished with two terminal setæ. In *Lichomolgus* proper, the inner branches of the same pair of feet are two-jointed, and the first joint has a seta on the inner distal angle, while the second carries two spines or spiniform setæ at the apex. According to this arrangement the following British species of the *Lichomolgidæ* will be included in the genus, *Pseudanthessius*, Claus.

Pseudanthessius liber (Brady and Robertson), as recorded above.
Pseudanthessius thorellii (Brady and Robertson), (= *Lichomolgus thorellii*, Brady and Robertson).
Pseudanthessius gracilis, Claus.
Pseudanthessius sauvagei, Canu.

The last three, as well as the first, have been obtained in the Forth, and will be referred to in the sequel.

The following British species of the *Lichomolgidæ* will be included in *Lichomolgus* proper :—

Lichomolgus fucicolus, Brady.
Lichomolgus furcillatus, Thorell.
Lichomolgus forficula, Thorell.
Lichomolgus albens, Thorell.
Lichomolgus hirsutipes, T. Scott. (Firth of Forth.)
Lichomolgus agilis, Leydig (= *Lichomolgus concinnus*, T. Scott. Firth of Forth.)

The following species of the *Lichomolgidæ* have also been recorded from the British seas :—

Sabelliphilus sarsi, Claparide (recorded by I. C. Thompson, Liverpool).

Species belonging to *Sabelliphilus* have the inner branches of the fourth pair of swimming-feet three jointed, and furnished with two barbed setæ on the inner margin, and two slender smooth setæ at the distal extremity. The first two joints of the anterior antennæ in *Sabelliphilus* are considerably dilated.

Herrmannella rostrata, Canu (1891) [= *Lichomolgus agilis*, T. Scott (1892). Firth of Forth.]

The structure and armature of the inner branches of the fourth pair in *Herrmannella* are somewhat similar to those of *Sabelliphilus*, but the first two joints of the anterior antennæ are cylindrical and not swollen as in that genus.

Modiolicola insignes, Aurivillius. (Firth of Forth.)

This species of the *Lichomolgidæ* somewhat resembles both *Sabelliphilus* and *Herrmannella* in the structure and armature of the fourth pair of feet. It also resembles *Herrmannella* in the form of the anterior antennæ, but it differs from *Sabelliphilus* in the first two joints of the anterior antennæ being cylindrical and not dilated; and it differs from *Herrmannella* in the anterior foot-jaws (the external second-maxillæ) being furnished with only one internal smooth seta on the basal part of the second joint; whereas in *Herrmannella*, there are two setæ on the inner part of the base of the second joint of the anterior foot-jaws, one seta being comparatively short and smooth, and one elongate and denticulate.

Lichomolgus arenicolus, Brady, is evidently not a true member of the genus *Lichomolgus*. In this species both branches of the fourth pair are three-jointed, and their armature is very similar to that of the second and third pairs; but it varies also in other structural details, and to such an extent that it cannot satisfactorily be placed in any of the genera I have referred to. The same may be said of an interesting species discovered some time ago by I. C. Thompson of Liverpool, and described by him under the name of *Lichomolgus maximus*; the species was found living as a mess-mate within the shell of the large scallop, *Pecten maximus*. That this is not a true *Lichomolgus*, according to the definition of the genus I have already referred to, will be at once apparent from the following quotation from Mr Thomson's description of the species. He says :— 'The first four pairs of swimming-feet have both branches three-jointed.' . . . . . 'It agrees with *Lichomolgus agilis*' (= *Herrmannella rostrata*, Canu) 'in having the inner branch of the fourth pair of swimming-feet 'three-jointed.' It is evident from this description, and independent of other structural differences, that *Lichomolgus maximus* is not, any more than *Lichomolgus arenicolus*, a true member of that genus; but the question as to which genus they should be assigned, to secure for them a satisfactory resting-place, is a matter requiring further study. It is quite possible that their structural details may not meet the conditions of any described genus. *Lichomolgus maximus*, however, appears to have a closer affinity with *Modiolicola* Aurivillius, than with any of the other genera referred to here.

Pseudanthessius thorellii (Brady and Robertson).

1875. *Lichomolgus thorellii*, Brady and Robertson (10), p. 197.
1880. *Lichomolgus thorellii*, Brady (8), vol. iii. p. 47, pl. lxxviii. figs. 1–9.
1893. *Lichomolgus thorellii*, I. C. Thompson (33), p. 33, pl. xxv. fig. 2 *c*.

Habitat.—Off St Monans. Scarce.

This appears to be one of the rarer species of *Lichomolgus*. I find comparatively few records of its occurrence in the British seas. Dr Brady obtained it at one or two places off the Durham and Yorkshire Coasts. Mr I. C. Thompson obtained it at Port Erin, Isle of Man; Moray Firth amongst *Fillograna* (A. S.); these, with the present record of its occurrence in the Forth, are the only British records for this species known to me.

Pseudanthessius sauvagei, Canu.

1891. *Pseudanthessius sauvagei*, Canu (10 *b*.), p. 481.
1892. *Pseudanthessius sauvagei*, Canu (11), p. 243, pl. xxv. figs. 1–17.
1894. *Pseudanthessius sauvagei*, T. and A. Scott (31), p. 146.

Habitat.—Off St Monans. Rare.

Want of time has prevented the preparation of drawings of this interesting species for the present paper.

Pseudanthessius gracilis, Claus.

1889. *Pseudanthessius gracilis*, Claus (13), vol. viii. p. 344, pl. iv. figs. 1–7.
1893. *Pseudanthessius gracilis*, T. and A. Scott (32), p. 241, pl. xii. figs. 15–20.

Habitat.—Off Musselburgh, among material collected in 1891. Some specimens were also taken in the Moray Firth among *Filograna implexa*.

One of the Moray Firth specimens measured 1·3 mm. ($\frac{1}{19}$th of an inch). The anterior antennæ are shorter than the first body segment, and seven-jointed; the third and the last joints are the shortest. The proportional lengths are shown by the formula:—

$$\frac{17 \cdot 20 \cdot 8 \cdot 14 \cdot 16 \cdot 13 \cdot 9 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot}$$

The third joint of the posterior antennæ is very small. The anterior foot-jaws are slender, and armed with a few strong teeth on the upper edge. A plumose seta springs from the inner edge near the base of the second joint. Posterior foot-jaws three-jointed. Second joint somewhat dilated, and bearing a short stout spine. The last joint very small, and armed with two terminal spines. Inner branches of the fourth pair of thoracic feet one-jointed, scarcely reaching to the end of the second joint of the outer branches, and armed with two dagger-shaped spines at the truncate apex. There is a small hook-like process near the middle of the inner margin. Fifth pair small, sub-quadrate, and furnished at the apex with an elongate dagger-like spine and a plain seta. Caudal stylets equal to about twice the length of the last abdominal segment. A small seta springs from near the middle of the outer margin of each stylet in addition to the terminal setæ.

This species differs from *Pseudanthessius thorellii* (B. and R.), with which it is closely allied, in the form of the anterior foot-jaws in the proportional length of the inner branches of the fourth pair of thoracic feet, and in the form of the abdomen.

Family Ascomyzontidæ.

Genus *Dermatomyzon*, Claus (1889).

[*Cyclopicera*, Brady (in part)].

Dermatomyzon gibberum, T. and A. Scott. (Pl. X. figs. 26–34.)

1894. *Dermatomyzon gibberum*, T. and A. Scott, p. 144, pl. ix. figs. 10–14.

Description.—Female. Length, ·5 mm. ($\frac{1}{50}$ of an inch). Cephalo-thorax broadly ovate, or pear-shaped. Abdomen very short; its length, including that of the stylets, is scarcely equal to one-fourth of the length of cephalo-thorax. Anterior antennæ stout, seventeen-jointed. The second basal joint

appears to be composed of two or three coalesced joints, as shown in the formula, which gives approximately the proportional lengths of the joints :—

$$\frac{40 \cdot (19 \cdot 10 \cdot 7) \cdot 8 \cdot 10 \cdot 12 \cdot 16 \cdot 9 \cdot 9 \cdot 16 \cdot 12 \cdot 12 \cdot 12 \cdot 12 \cdot 16 \cdot 18 \cdot 8 \cdot 26 \cdot}{1 \cdot \quad \cdot 2 \cdot \quad \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 \cdot 11 \cdot 12 \cdot 13 \cdot 14 \cdot 15 \cdot 16 \cdot 17 \cdot}$$

Mandibles stylet-shaped, stout, and elongate. The mandible-palp consists of a single oblong joint, the length of which is greater than twice the breadth; and three stout, moderately long and nearly equal setæ spring from its truncate apex. The maxillæ are composed of a sub-triangular primary part, furnished with three apical setæ, and a narrow cylindrical secondary part, provided with four setæ at the apex. The anterior foot-jaws have the basal part stout, but the end is slender and curved, and forms a claw-like appendage. The posterior foot-jaws and swimming-feet are somewhat like those of *Dermatomyzon nigripes* (Brady and Robertson). The fifth pair are simple and two-jointed. The first joint is short, and its breadth is about equal to twice the length, and a seta springs from its upper distal angle. The second joint is longer and narrower, the length being about twice the breadth. It is furnished with two apical setæ. The caudal stylets are nearly as long as broad, and are equal to the combined lengths of the last two abdominal segments.

Habitat.—Vicinity of the Bass Rock. Rare.

The very tumid form of the cephalo-thorax and short abdomen give to this species a very curious and striking appearance that at once distinguishes it from all other Copepods known to us.

Genus *Acontiophorus*, Brady (1880).

Acontiophorus elongatus, T. and A. Scott.

1894. *Acontiophorus elongatus*, T. and A. Scott (31), p. 145, pl. ix. figs. 15–20.

Description.—Female. Length, 1 mm. ($\frac{1}{25}$ of an inch). This is an elongate form. The abdomen is slender, and equal to about two-thirds of the length of the cephalo-thorax. The anterior antennæ are slender, and composed of seventeen joints. The proportional lengths are as follow :—

$$\frac{24 \cdot 12 \cdot 14 \cdot 6 \cdot 6 \cdot 6 \cdot 9 \cdot 6 \cdot 8 \cdot 14 \cdot 12 \cdot 13 \cdot 13 \cdot 14 \cdot 14 \cdot 14 \cdot 24 \cdot}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 \cdot 11 \cdot 12 \cdot 13 \cdot 14 \cdot 15 \cdot 16 \cdot 17 \cdot}$$

Posterior antennæ and mouth organs are nearly as in *Acontiophorus scutatus* (Brady and Robertson). The mandibles are extremely long and slender, being about equal in length to the elongate siphon. Foot-jaws and swimming-feet also somewhat similar to those of *Acontiophorus scutatus*, but the fourth pair are armed with remarkably broad and stout dagger-shaped spines on the exterior margins of the outer branches, and broad sabre-like terminal spines on both branches. The fifth pair consists each of a single elliptical joint, furnished with three apical setæ. Caudal stylets very short.

Habitat.—Vicinity of the Rock. Frequent.

Remarks.—The slender form of this species, and especially of its elongate and slender abdomen, enables this species to be distinguished from any other described *Acontiophorus*. It differs from the typical *Acontiophorus scutatus* in the posterior antennæ having only one long and slender spine at the apex instead of two lancet-shaped apical spines, but otherwise the species now described is a true *Acontiophorus*.

II. OSTRACODA.

Family Cytheridæ.

Genus *Cytheropteron*, G. O. Sars.

Cytheropteron humile, Brady and Norman.

1889. *Cytheropteron humile*, Brady and Norman (9), p. 219, pl. xx. figs. 4–7.

Habitat.—Largo Bay, and off Limekilns to the west of Queensferry. Rare.

Two specimens were obtained in a dead cyprina shell dredged in Largo Bay, and a third specimen was obtained in material collected off Limekilns. This interesting species seems to be comparatively rare. It has been taken in the Clyde, in the vicinity of Greenock; and the Marquis de Folin has obtained it in material dredged off Vigo.

III. AMPHIPODA.

Family Lysianassidæ.

Genus *Acidostoma*, Lilljeborg (1865).

Acidostoma obesum (Spence Bate).

1862. *Anonyx obesus*, Sp. Bate (3), p. 74, pl. xii. fig. 1.
1888. *Anonyx obesus*, D. Robertson (26), p. 17.
1890. *Acidostoma obesum*, G. O. Sars (26), p. 38, pl. xiv. fig. 2.

Habitat.—Between Fidra and the Bass Rock. Not common.

Genus *Orchomene*, Boeck (1870).

Orchomene batei, G. O. Sars.

1882. *Orchomene batei*, G. O. Sars (28), i. p. 81.
1862. *Anonyx edwardsi*, Spence Bate (3), p. 73, pl. xi. fig. 5.
1892. *Orchomene batei*, Robertson (27), p. 11.

Habitat.—Vicinity of the Bass Rock. Rather rare.

Genus *Lepidepecreum*, Spence Bate (1868).

Lepidepecreum carinatum, Bate and Westwood.

1868. *Lepidepecreum carinatum*, B. and W. (4), vol. ii. p. 509.
1862. *Anonyx longicornis*, Spence Bate (3), p. 72 (♂).
1888. *Lepidepecreum carinatum* and *Anonyx longicornis*, Robertson (26), p. 91.
1891. *Lepidepecreum carinatum*, G. O. Sars (29), p. 113, pl. xxxix. fig. 1.

Habitat.—Off St Monans and other parts of the Forth. Not common. I have this species also from the Moray Firth.

Family Phoxocephalidæ.

Genus *Harpinia*, Boeck (1876).

Harpinia crenulata, Boeck.

1870. *Harpinia crenulata*, Boeck (7), p. 56.
1891. *Harpinia crenulata*, G. O. Sars (29), p. 158, pl. lv. fig. 2.
1894. *Harpinia crenulata*, T. and A. Scott (31), p. 147.

Habitat.—Vicinity of Inchkeith Island and other parts of the Forth. Not uncommon. The second last pair of pereiopods are comparatively long. The epimeral plates of the last segment of the metasom have the lower distal angle rounded, and provided posteriorly with a single small tooth on either side, or with two or three small teeth of unequal size.

Family Ampeliscidæ.

Genus *Haploops*, Lilljeborg (1855).

Haploops tubicola, Lilljeborg.

1855. *Haploops tubicola*, Lilljeborg (21), p. 134.
1868. *Haploops tubicola*, Bate and Westwood (4), vol. ii. p. 505.
1888. *Haploops tubicola*, D. Robertson (26), p. 22.
1891. *Haploops tubicola*, G. O. Sars (29), p. 192, pl. lxvii.

Habitat.—Vicinity of the Bass Rock (1892), and in other parts of the Forth area. Though not recorded till now, this species has been in my possession for a considerable time. The Forth specimens are comparatively small. Another species of the Ampeliscidæ, *Byblis gaimardii*, Kröyer, has been, on the authority of Metzger,* recorded from the vicinity of St Abb's Head, at the mouth of the Firth of Forth (*see* Leslie and Herdman's 'Invertebrate Fauna of the Firth of Forth,' p. 105 (Appendix), and 'Revised List of Crustacea of the Firth of Forth,' by the author); but G. O. Sars, in his new work on 'The Crustacea of Norway,' does not include the British Islands in his notes on the distribution of the species. It is, perhaps, therefore right to state that I am able to corroborate Metzger's record from having been fortunate in capturing a fine specimen of *Byblis gaimardii*, Kröyer, near the May Island, in January 1890. Had there been time a description with drawings of the species would have been prepared for the present Report, but this may be done later.

Family Amphilochidæ.

Genus *Amphilochoides*, G. O. Sars (1892).

Amphilochoides pusillus, G. O. Sars.

1892. *Amphilochoides pusillus*, G. O. Sars (29), p. 222, pl. lxxvi. fig. 1.
1894. *Amphilochoides pusillus*, T. and A. Scott (31), p. 147.

Habitat.—Vicinity of the Bass Rock. Not common. This species has no tooth at the base of the dactylus of the first pair of gnathopods, and the palm of the second pair of gnathopods is finely serrate only on the distal half; the other half is even, or nearly so, and bears a few minute setæ.

Family Stenothoidæ.

Genus *Metopa*, Boeck (1870).

Metopa propinqua, G. O. Sars.

1892. *Metopa propinqua*, G. O. Sars (29), p. 264, pl. xciii. fig. 1.

Habitat.—Off Crail, 1892. Rare.

The telson of this species is furnished with three strong denticles on each side of the upper surface and near to the margin. The second gnathopods are also moderately stout. The Forth specimen agrees with Sars' description of the species in all its principal characters. Several of the species of *Metopa* are very small and troublesome to diagnose.

* Crustacea u. Mollusca v. d. Nordseefahrt d. 'Pomerania,' 1872. (Berlin, 1875.)

Family Leucothoidæ.

Genus *Leucothoë*, Leach (1814).

Leucothoë lilljeborgii, Boeck, 1860.

1860. *Leucothoë lilljeborgii*, Boeck, Forhandl. Skand. Naturf. 8 de Mode.
1888. *Leucothoë furina*, Chevreux (non furina Savigny) (12), p. 9.
1889. *Leucothoë imparicornis*, Norman (24), p. 114, pl. x. figs. 1–4.
1892. *Leucothoë incisa*, Robertson (27), p. 23.

Habitat.—Vicinity of the Bass Rock. Rare. This species is readily recognised by the form of the last pair of epimeral plates of the metasome.

Family Paramphithoidæ.

Genus *Paramphithoë*, Bruzelius (1859).

Paramphithoë monocuspis, G. O. Sars.

1893. *Paramphithoë monocuspis*, G. O. Sars (29), p. 351, pl. cxxiii. fig. 2.

I record this species for the Firth of Forth on the authority of Dr A. M. Norman. It was sent to him by Dr Henderson in 1884. Some time ago, when looking over a number of Forth Amphipoda, I observed one of the specimens with a single dorsal cusp, which, on further examination, was found to resemble this species fairly well: it was, however, laid aside for further study.

Paramphithoë assimilis, G. O. Sars.

1882. *Paramphithoë assimilis*, G. O. Sars (28), p. 99, pl. v. fig. 1.
1888. *Paramphithoë assimilis*, D. Robertson (26), p. 94.
1893. *Paramphithoë assimilis*, G. O. Sars (29), p. 352, pl. cxxiv. fig. 1.

Habitat.—Found adhering to some zoophytes dredged between the Island of Inchkeith and the May. The Forth specimens belong to *Paramphithoë assimilis*, G. O. Sars, as described in 'Crustacea of Norway,' and not to *Pleustis glaber*, Boeck (*Parapleustis glaber* in 'Crustacea of 'Norway,' p. 358).

Family Iphimedidæ.

Genus *Iphimedia*, Rathke (1843).

Iphimedia minuta, G. O. Sars.

1882. *Iphimedia minuta*, G. O. Sars (28), p. 100, pl. v. fig. 2.
1892. *Iphimedia minuta*, D. Robertson (27), p. 23.
1893. *Iphimedia minuta*, G. O. Sars (29), p. 379, pl. cxxxiii. fig. 1.

Habitat.—North end of Inchkeith, and in other parts of the Forth.

This species has been known to me for a considerable time as quite distinct from *Iphimedia obesa*. Though not a common species it has been obtained at several places within the estuary.

Family Atylidæ.

Genus *Apherusa*.

Apherusa borealis (Boeck).

1893. *Apherusa borealis*, G. O. Sars (29), p. 441, pl. cxv. fig. 2.

Habitat.—In various places within the Forth area, between the Island of Inchkeith and the May, as well as outside of the May Island. Sometimes

frequent in the tow-net collections. The two dorsal cusps appear to be stronger in the male than in the female. The telson is of the form of narrow triangular plate with a pointed extremity, and furnished with a minute hair on each side of the apex.

ANNELIDA.

Family NEMERTIDÆ.

Genus *Cerebratulus.*

Cerebratulus angulatus (O. F. Müller).

1853. *Gordius fragilis*, Sir John Dalyell (15), vol. ii. p. 55, pls. vi., vii., vii*.

1874. *Cerebratulus angulatus*, W. C. M'Intosh (22), p. 175.

1894. *Cerebratulus angulatus*, T. Scott, Ann. and Mag. Scot. Nat. Hist., Part 10, p. 118.

A specimen of *Cerebratulus angulatus*, measuring about 14 inches in length, was obtained among some trawl refuse from Largo Bay (off the Wemyss). I cannot find any previous record of *Cerebratulus* having been taken in the Forth. Harry Goodsir and Sir John Dalzell publish records of this species for Scotland, but do not give the localities.

MOLLUSCA.

CONCHIFERA.

Family PANDORIDÆ.

Genus *Lyonsia*, Turton.

Lyonsia norvegica (Chemnitz).

1865. *Lyonsia norvegica*, J. G. Jeffreys (19), vol. iii. p. 29 (vol. v. p. 190, pl. xlviii. fig. 2.)

Habitat.—Vicinity of the Bass Rock; depth of water 22–23 fathoms. Bottom, sandy mud. A living specimen of this mollusc was taken a short distance north-east of the Bass Rock on 30th October 1893. There does not appear to have been hitherto any very satisfactory record of the occurrence of *Lyonsia* in the Firth of Forth. There is no record of its occurrence in the Forth, either by the Rev. W. Wood (East Neuk of Fife), or by Leslie and Herdman (Invertebrate Fauna of the Firth of Forth). Dr Henderson, in his notes on the Forth Invertebrates, in the Proceedings of the Royal Physical Society of Edinburgh (1883–84), records the discovery of 'a single broken valve at Newhaven'; but he states distinctly that 'in all cases where "Newhaven" is given as the locality, it must be 'understood that the specimens are from the fishermen's lines, and probably 'taken to the east of the May Island.' The present is therefore the only satisfactory record I know of for *Lyonsia norvegica* as a member of the Forth fauna.

The following is a list of some of the works more particularly referred to in this contribution towards a Natural History of the Firth of Forth :—

1. 1883. AURIVILLIUS, C. W. S., *Bidrag till Kännedomen om Krustaceer, som lefva hos Mollusker och Tunikater; Akademisk Afhandling.*

2. 1850. Baird, W., 'Natural History of British Entomostraca'; Ray Society.
3. 1862. Bate, C. S., *Catalogue of Amphipodous Crustacea in the British Museum.*
4. 1863–68. Bate, C. S., and Westwood, *A History of the British Sessile-eyed Crustacea*, vol. i. 1863, vol. ii. 1868.
5. 1864. Boeck, A., 'Oversigt över de ved Norges Kyster jagttagne Copepoder henhorende til *Calanidernes*,' *Cyclopidernes Familier;* Forhandl. i. Vidensk, Selskab i. Christiania.
6. 1872. Boeck, A., *Nye Slaegter og Arter of Saltvands Copepoder;* Forhandl. i. Vidensk, Selskab i. Christiania.
7. 1870. Boeck, A., *Crustacea Amphipoda borealis et Arctic*, Christiania.
7*a*. 1872. Brady, *Nat. Hist. Trans.*, Northumberland and Durham, vol. iv.
8. 1878–80. Brady, G. S., 'A Monograph of the Free and Semi-parasitic Copepoda of the British Islands,' Ray Society. Vol. i. 1878.
9. 1889. Brady and Norman, 'Monograph of the Marine and Fresh Water Ostracoda of the North Atlantic and North-western Europe.'
10. 1875. Brady and Robertson, 'Report on Dredging off the Coast of Durham and North Yorkshire in 1874.' In Rep. 45. Meet. British Ass., Adv. Ser.
10*a*. 1890. Canu, Eugène, 'Les Copepodes marins du Boulonnais' (*Bulletin Scien. de la France, et de la Belgique*, vol. xxii.).
10*b*. 1891. Canu, Eugène, 'Les Copepodes marins du Boulonnais' (*idem*, vol. xxiii.).
11. 1892. Canu, Eugène, 'Les Copepodes du Boulonnais, Morphologie, Embryologie, Taxonomie (*Travaux du Labor. de Zool. Maritime de Wimereux;* Ambleteuse, vol. vi.).
12. 1888. Chevreux, E., *Bulletin de la Société d'etudis scientifiques de Paris* 11e année 1er semestre.
13. 1889. Claus, C., 'Ueber neue oder wenig bekennte halbparasitische, Copepoden, insbesondere der Lichomolgiden,—und Ascomyzontiden—gruppen,' Arl. Zool. Inst. Wien. t. viii.
14. 1863. Claus, C., *Die freilebenden Copepoden, mit besonderer Berücksichtig ung. der Fauna Deutschlands, der Nordsee und des Mittelmeeres*, Leipsic.
15. 1855. Dalyell, Sir John, *Powers of the Creator.*
16. 1882. Giesbrecht, W., *Die freilebenden Copepoden, der Kieler Föhrde vii.tes Jahresbericht d. Commiss. f. wiss. Unters d. deutschen Meere.*
17. 1892. Giesbrecht, W., *Fauna und Flora des Golfes von Neapel* (*Monographie Pelagische Copepoden systematik und faunistik*).
18. 1845. Goodsir, H., 'Descriptions of some Gigantic Forms of Invertebrate Animals from the Coast of Scotland.' (*Annals and Magazine of Natural History*, vol. xv.).
19. 1862–69. Jeffreys, J. Gwyn, *British Conchology.*
20. 1881. Leslie and Herdman, *The Invertebrate Fauna of the Firth of Forth.*
21. 1855. Lilljeborg, W., *Ofvers af Vetinskap. Akad. Forhandl.*
22. 1874. M'Intosh, W. C., *Monograph of British Annelids.*

23. 1875. M'Intosh, W. C., *The Marine Fauna of St Andrews Bay.*
24. 1889. Norman, A. M., 'Notes on British Amphipoda—1. Megaluropes, n.g., and some Œdiceridæ.' (*Annals and Magazine of Natural History*, June.)
25. 1892. Norman, A. M., *idem*, 'Families Leucothoidæ, Pardaliscidæ, and Gammaridæ (Marine).'
26. 1888. Robertson, D., *A Contribution towards a Catalogue of the Amphipoda and Isopoda of the Clyde.*
27. 1892. Robertson, D., *A Second Contribution towards a Catalogue of the Amphipoda and Isopoda of the Clyde.*
28. 1882. Sars, G. O., *Oversigt af Norges Crustaceer*, pt. i.
29. 1890–93. Sars G. O., *An Account of the Crustacea of Norway*, pts. i.–xxi.
30. 1894. Scott, T., 'Report on Entomostraca from the Gulf of Guinea' (*Transactions of the Linnean Society, London*, 2nd ser., Zoology, vol. vi.), vol. vi. pt. i.
31. 1894. Scott, T. and A., 'On some New and Rare Crustacea from Scotland.' (*Annals and Magazine of Natural History*, ser. vi., vol. xii., February.)
32. 1893. Scott, T. and A., 'On some New and Rare Crustacea from Scotland.' (*Annals and Magazine of Natural History*, ser. vi., vol. xii., October.)
33. 1893. Thompson, I. C., *Revised Report on the Copepoda of Liverpool Bay.*
34. 1888–90. Walker, A. O., 'Higher Crustacea of Liverpool Bay.' (*Trans. Biol. Soc., Liverpool.*)
35. 1891. Walker, A. O., 'On Pherusa fucicola (Leach).' (*Annals and Magazine of Natural History*, ser. vi., vol. vii.
36. 1885. White, A., *History of the British Crustacea.*
37. 1862. Wood, Rev. W., *The East Neuk of Fife; its Histories and Antiquities: Geology, Botany, and Natural History in General.*
38. 1885. Wright, R., *On a Parasite Copepod of the Clam* (Myicola metisiensis).

DESCRIPTION OF THE PLATES.

Plate V.

Pseudocyclopia caudata, sp. nov.

Fig. 1. Female, lateral view, ... × 32 diameters.
Fig. 2. Anterior antenna of the same, ... × 456 ,,
Fig. 3. Foot of first pair, ... × 456 ,,
Fig. 4. Foot of second pair, ... × 190 ,,
Fig. 5. Foot of third pair, ... × 168 ,,
Fig. 6. Foot of fourth pair, ... × 338 ,,
Fig. 7. Fifth pair of feet, ... × 570 ,,
Fig. 8. Abdomen and caudal stylets, . . . × 95 ,,

Cyclopina elegans, sp. nov.

Fig. 9. Female, dorsal view, ... × 54 diameters
Fig. 10. Anterior antenna—female, ... × 300 ,,
Fig. 11. Anterior antenna—male . . . . × 300 ,,
Fig. 12. Posterior antenna, ... × 338 ,,
Fig. 13. Mandible and palp, ... × 253 ,,
Fig. 14. Maxilla, ... × 253 ,,
Fig. 15. Anterior foot-jaw, ... × 253 ,,
Fig. 16. Posterior foot-jaw, ... × 500 ,,
Fig. 17. Foot of first pair, ... × 300 ,,
Fig. 18. Foot of fourth pair, ... × 200 ,,
Fig. 19. Foot of fifth pair, ... × 380 ,,

Ameira reflexa, sp. nov.

Fig. 20. Female, lateral view, ... × 106 diameters.
Fig. 21. Anterior antenna of the same, . . . × 500 ,,
Fig. 22. Posterior antenna, ... × 500 ,,
Fig. 23. Mandible and palp, ... × 500 ,,
Fig. 24. Posterior foot-jaw, ... × 760 ,,
Fig. 25. Foot of first pair, ... × 253 ,,
Fig. 26. Foot of fourth pair, ... × 135 ,,
Fig. 27. Foot of fifth pair, ... × 253 ,,
Fig. 28. Part of abdomen and caudal stylets, . . × 228 ,,

Ameira longiremis, sp. nov.

Fig. 29. Posterior antenna, ... × 380 diameters.
Fig. 30. Posterior foot-jaw, ... × 456 ,,
Fig. 31. Foot of fifth pair, ... × 380 ,,
Fig. 32. Caudal stylets, ... × 152 ,,

PLATE VI.

Ameira longiremis, sp. nov.

Fig. 1. Female, lateral view, ... × 96 diameters.
Fig. 2. Anterior antenna of the same, . . . × 456 ,,
Fig. 3. Mandible and palp, ... × 380 ,,
Fig. 4. Foot of first pair, ... × 380 ,,
Fig. 5. Foot of fourth pair, ... × 380 ,,

Ameira longiremis, var. *intermedia*.

Fig. 6. Female, lateral view, ... × 53 diameters.
Fig. 7. Anterior antenna of the same, . . . × 456 ,,
Fig. 8. Posterior antenna, ... × 380 ,,
Fig. 9. Mandible and palp, ... × 456 ,,
Fig. 10. Posterior foot-jaw, ... × 500 ,,
Fig. 11. Foot of first pair, ... × 380 ,,
Fig. 12. Foot of fourth pair, ... × 190 ,,
Fig. 13. Foot of fifth pair, ... × 380 ,,
Fig. 14. Abdomen and caudal stylets, . . . × 190 ,,

Ameira exigua, sp. nov.

Fig. 15. Female lateral view, ... × 106 diameters.
Fig. 16. Anterior antenna of the same, . . . × 500 ,,
Fig. 17. Posterior antenna, ... × 500 ,,
Fig. 18. Mandible and palp, ... × 500 ,,
Fig. 19. Posterior foot-jaw, ... × 760 ,,
Fig. 20. Foot of first pair, ... × 380 ,,
Fig. 21. Foot of fourth pair, ... × 380 ,,
Fig. 22. Foot of fifth pair, ... × 456 ,,
Fig. 23. Abdomen and caudal stylets, . . . × 127 ,,

Laophonte depressa, sp. nov.

Fig. 24. Female, dorsal view, ... × 54 diameters.
Fig. 25. Mandible and palp, ... × 380 ,,
Fig. 26. Posterior foot-jaw, ... × 254 ,,
Fig. 27. Foot of first pair, ... × 168 ,,
Fig. 28. Foot of fourth pair, ... × 126 ,,
Fig. 29. Foot of third pair—male, ... × 190 ,,
Fig. 30. Foot of fifth pair—female, ... × 254 ,,
Fig. 31. Foot of fifth pair—male (*a.* appendage to first abdominal segment), ... × 380 ,,

Plate VII.

Laophonte depressa, sp. nov.

Fig. 1. Anterior antenna of female, ... × 254 diameters.
Fig. 2. Anterior antenna of male, ... × 254 ,,
Fig. 3. Posterior antenna, ... × 254 ,,

Tetragoniceps consimilis, sp. nov.

Fig. 4. Female, lateral view, ... × 106 diameters.
Fig. 5. Anterior antenna of the same, . . . × 254 ,,
Fig. 6. Postrerior antenna, ... × 500 ,,
Fig. 7. Mandible and palp, ... × 380 ,,
Fig. 8. Posterior foot-jaw, ... × 500 ,,
Fig. 9. Foot of first pair, ... × 380 ,,
Fig. 10. Foot of fourth pair, ... × 380 ,,
Fig. 11. Foot of fifth pair, ... × 152 ,,
Fig. 12. Abdomen and caudal stylets, . . . × 190 ,,

Laophonte denticornis, sp. nov.

Fig. 13. Female, dorsal view, ... × 80 diameters.
Fig. 14. Anterior antenna—female, ... × 338 ,,
Fig. 15. Anterior antenna—male, ... × 338 ,,
Fig. 16. Posterior antenna, ... × 338 ,,
Fig. 17. Mandible and palp, ... × 500 ,,
Fig. 18. Posterior foot-jaw, ... × 380 ,,
Fig. 19. Foot of first pair, ... × 338 ,,
Fig. 20. Foot of fourth pair, ... × 380 ,,
Fig. 21. Foot of third pair—male, ... × 250 ,,
Fig. 22. Foot of fifth pair—female, ... × 250 ,,
Fig. 23. Foot of fifth pair—male (*a.* appendage to first abdominal segiment), ... × 380 ,,

Laophonte simulans, sp. nov.

Fig. 24. Female, dorsal view, ... × 106 diameters.
Fig. 25. Posterior antenna, ... × 380 ,,
Fig. 26. Mandible and palp, ... × 380 ,,
Fig. 27. Posterior foot-jaw, ... × 380 ,,
Fig. 28. Foot of first pair, ... × 380 ,,
Fig. 29. Foot of third pair, ... × 380 ,,
Fig. 30. Foot of fourth pair, ... × 500 ,,
Fig. 31. Foot of fifth pair, ... × 380 ,,
Fig. 32. Abdomen and caudal stylets, . . . × 190 ,,

Plate VIII.

Laophonte simulans, sp. nov.

Fig. 1. Anterior antenna—female, ... × 380 diameters.

Laophontodes typicus, gen. et sp. nov.

Fig. 2. Female, dorsal view, ... × 190 diameters.
Fig. 3. Anterior antenna of the same, . . . × 500 ,,
Fig. 4. Posterior antenna, ... × 500 ,,
Fig. 5. Posterior foot-jaw, ... × 500 ,,
Fig. 6. Foot of first pair, ... × 500 ,,
Fig. 7. Foot of fourth pair, ... × 500 ,,
Fig. 8. Foot of fifth pair, ... × 500 ,,

Pontopolites typicus, gen. et sp. nov.

Fig. 9. Female, lateral view, ... × 106 diameters.
Fig. 10. Anterior antenna of the same, . . . × 380 ,,
Fig. 11. Posterior antenna, ... × 380 ,,
Fig. 12. Mandible and palp, ... × 760 ,,
Fig. 13. Posterior foot-jaw, ... × 760 ,,
Fig. 14. Foot of first pair, ... × 380 ,,
Fig. 15. Foot of fourth pair, ... × 380 ,,
Fig. 16. Foot of fifth pair, ... × 380 ,,
Fig. 17. Abdomen and caudal stylets, . . . × 127 ,,

Cletodes curvirostris, sp. nov.

Fig. 18. Female, lateral view, . . . × 70 diameters.
Fig. 19. Anterior antenna of the same, . . . × 380 ,,
Fig. 20. Posterior antenna, ... × 380 ,,
Fig. 21. Mandible and palp, ... × 500 ,,
Fig. 22. Posterior foot-jaw, ... × 760 ,,
Fig. 23. Foot of first pair, ... × 380 ,,
Fig. 24. Foot of fourth pair, ... × 380 ,,
Fig. 25. Foot of fifth pair, ... × 380 ,,
Fig. 26. Abdomen and caudal stylets, . . . × 106 ,,

Heteropsyllus curticaudatus, gen. et sp. nov.

Fig. 27. Female, lateral view, ... × 160 diameters.
Fig. 28. Anterior antenna of the same, . . . × 380 ,,
Fig. 29. Posterior antenna, ... × 760 ,,
Fig. 30. Mandible and palp, ... × 760 ,,
Fig. 31. Posterior foot-jaw, ... × 760 ,,
Fig. 32. Foot of first pair, ... × 380 ,,
Fig. 33. Foot of fourth pair, ... × 300 ,,
Fig. 34. Abdomen and caudal stylets, . . . × 190 ,,

Plate IX.

Heteropsyllus curticaudatus, gen. et sp. nov.

Fig. 1. Foot of fifth pair, ... × 380 diameters.

Leptopsyllus typicus, gen. et sp. nov.

Fig. 2. Female, dorsal view, ... × 106 diameters.
Fig. 3. Anterior antenna of the same, . . . × 500 ,,
Fig. 4. Posterior antenna, ... × 500 ,,
Fig. 5. Mandible and palp, ... × 760 ,,
Fig. 6. Anterior foot-jaw, ... × 760 ,,
Fig. 7. Posterior foot-jaw, ... × 760 ,,
Fig. 8. Foot of first pair, ... × 760 ,,
Fig. 9. Foot of third pair, ... × 760 ,,
Fig. 10. Foot of fourth pair, ... × 760 ,,
Fig. 11. Foot of fifth pair, ... × 760 ,,

Andrew Scott, del. ad nat.

Figs. 1–8.—Pseudocyclopia caudata, *sp. nov.* Figs. 9–19.—Cyclopina elegans, *sp. nov.* Figs. 20–28.—Ameira reflexa, *sp. nov.* Figs. 29–32.—Ameira longiremis, *sp. nov.*

Andrew Scott, del. ad nat.

Figs. 1–5.—Ameira longiremis, *sp. nov.* Figs. 6–14.—Ameira longiremis, *var. intermedia.* Figs. 15–23.—Ameira exigua, *sp. nov.* Figs. 24–31.—Laophonte depressa, *sp. nov.*

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Figs. 1–3.—Laophonte depressa, *sp. nov.* Figs. 4–12.—Tetragoniceps consimilis, *sp. nov.* Figs. 13–23.—Laophonte denticornis, *sp. nov.* Figs. 24–32.—Laophonte simulans, *sp. nov.*

Andrew Scott, del. ad nat.

Fig. 1.—Laophonte simulans, *sp. nov.* Figs. 2–8.—Laophontodes typicus, *gen. et sp. nov.* Figs. 9–17.—Pontopolites typicus, *gen. et sp. nov.* Figs. 18–26.—Cletodes curvirostris, *sp. nov.*

Figs. 27–34. –Heteropsyllus curticaudatus, *gen. et sp. nov.*

Andrew Scott, del. ad nat.

Fig. 1.—Heteropsyllus curticaudatus, *gen. et sp. nov.* Figs. 2–11.—Leptopsyllus typicus, *gen. et sp. nov.* Figs. 12–20.—Dactylopus coronatus, *sp. nov.*
Figs. 21–29.—Pseudowestwoodia andrewi, *gen. et sp. nov.* Fig. 30.—Ameira exilis (*T. & A. Scott*).

Andrew Scott, del. ad nat.

Figs. 1–12.—**Ameira exilis** (*T. & A. Scott*). Figs. 13–25.—**Thalestris forficuloides** (*T. & A. Scott*). Figs. 26–34.—**Dermatomyzon gibberum** (*T. & A. Scott*).

Dactylopus coronatus, sp. n.

Fig. 12. Female, dorsal view, × 80 diameters.
Fig. 13. Anterior antenna of the same, × 380 ,,
Fig. 14. Posterior antenna, × 253 ,,
Fig. 15. Mandible and palp, × 253 ,,
Fig. 16. Posterior foot-jaw, × 380 ,,
Fig. 17. Foot of first pair, × 253 ,,
Fig. 18. Foot of fourth pair, × 190 ,,
Fig. 19. Foot of fifth pair, × 380 ,,
Fig. 20. Abdomen and caudal stylets, × 126 ,,

Pseudowestwoodia andrewi, gen. et sp. nov.

Fig. 21. Female, lateral view, × 106 diameters.
Fig. 22. Anterior antenna of the same, × 500 ,,
Fig. 23. Posterior antenna, × 500 ,,
Fig. 24. Mandible and palp, × 500 ,,
Fig. 25. Posterior foot-jaw, × 760 ,,
Fig. 26. Foot of first pair, × 500 ,,
Fig. 27. Foot of fourth pair, × 380 ,,
Fig. 28. Foot of fifth pair, × 760 ,,
Fig. 29. Abdomen and caudal stylets, × 380 ,,

Ameira exilis, T. and A. Scott.

Fig. 30. Male spermatophore, × 160 diameters.

Plate X.

Ameira exilis, T. and A. Scott.

Fig. 1. Female, lateral view, × 53 diameters.
Fig. 2. Anterior antenna—female, × 168 ,,
Fig. 3. Anterior antenna—male, × 190 ,,
Fig. 4. Posterior antenna, × 254 ,,
Fig. 5. Mandible and palp, × 500 ,,
Fig. 6. Posterior foot-jaw, × 500 ,,
Fig. 7. Foot of first pair, × 190 ,,
Fig. 8. Foot of fourth pair, × 126 ,,
Fig. 9. Foot of third pair—male, × 126 ,,
Fig. 10. Foot of fifth pair—female, × 190 ,,
Fig. 11. Foot of fifth pair—male (*a*. appendage to first abdominal segment), × 190 ,,
Fig. 12. Abdomen and caudal stylets, × 80 ,,

Thalestris forficuloides, T. and A. Scott.

Fig. 13. Female, lateral view, × 80 diameters.
Fig. 14. Anterior antenna—female, × 254 ,,
Fig. 15. Anterior antenna—male, × 254 ,,
Fig. 16. Posterior antenna, × 500 ,,
Fig. 17. Mandible and palp, × 500 ,,
Fig. 18. Maxilla, × 380 ,,
Fig. 19. Posterior foot-jaw, × 500 ,,
Fig. 20. Foot of first pair, × 254 ,,
Fig. 21. Foot of fourth pair, × 190 ,,
Fig. 22. Foot of third pair—male, × 190 ,,
Fig. 23. Foot of fifth pair—female, × 127 ,,
Fig. 24. Foot of fifth pair—male, × 254 ,,
Fig. 25. Abdomen and caudal stylets, × 80 ,,

Dermatomyzon gibberum, T. and A. Scott.

Fig. 26. Female, dorsal view, × 106 diameters.
Fig. 27. Anterior antenna of the same, × 334 ,,
Fig. 28. Mandible and palp, × 456 ,,
Fig. 29. Maxilla, × 456 ,,
Fig. 30. Anterior foot-jaw, × 254 ,,
Fig. 31. Posterior foot-jaw, × 380 ,,
Fig. 32. Foot of first pair, × 254 ,,
Fig. 33. Foot of fourth pair, × 254 ,,
Fig. 34. Foot of fifth pair, × 760 ,,

III.—ON THE SKELETON OF THE TUNNY.

By Arthur T. Masterman, B.A. (Cant.), University Assistant and Lecturer in Natural History, University of St Andrews. (Plates XI., XII.).

On the 16th of October 1885, a large specimen of the common tunny was caught in the Firth of Forth, and in the April number for 1886 of the 'Annals and Magazine of Natural History' appeared a few notes by Professor M'Intosh upon the external characters and anatomy of this fish.

The skeleton being now in the St Andrews University Museum, and readily accessible for examination, at the suggestion of Professor M'Intosh the following detailed description was undertaken. This was felt to be the more necessary, as apparently no very exhaustive resumé of the osteology of this fish seems to have been compiled, though Cuvier, Owen, Mivart, and others briefly refer to sundry leading peculiarities in its skull, vertebræ, or ribs.

The specimen here described is a large one, being close upon 9 feet from tip to tip, and 6 feet 5 inches in its largest girth.

The Skull.—The general structural modifications of the skull are very peculiar. On the dorsal surface the median crest is well marked posteriorly (fig. 3), and is formed by part of the supra-occipital, which is also continued well out beyond the posterior border of the cranium; in front the crest is double, being composed of the two approximated raised inner edges of the frontals, which, however, do not fuse, and between which is a deep groove. This groove just in front of the supra-occipital becomes a median foramen leading into the cranial cavity (figs. 2 and 3).

The 'crêtes intermediaires' (*Cuvier*) form one of the most prominent features of the skull. Each is a long elevated ridge, composed of parts of the parietals, epiotics, and frontals; rising in front from the pre-frontal region it runs round in a curve to form the edge of the epiotic process posteriorly (fig 3).

Internal to this crest the sides slope inwards and downwards to form a basin, in the centre of which is a large paired lateral foramen which passes directlyinto the cranial cavity.

External to the lateral crests the dorsal surface of the skull is smooth, and has a deep furrow leading outwards to the end of the parotic process.

Anteriorly this part narrows off until its outer edge, the supra-orbital ridge, meets the lateral crest in the pre-orbital region, and posteriorly it is bounded by a ridge which runs along the postero-dorsal margin from the supra-occipital region to the end of the parotic process.

The posterior surface is small, and looks postero-dorsally rather than posteriorly (fig. 2). It ends behind in a free edge formed by the ex-occipital, opisthotic, and pterotic. The two parotic processes are large (figs. 1, 2, and 3, *pt.t.*), and form the two basal angles of the truncated triangle, the shape of which the skull assumes. They are mostly formed by flattened wing-like processes of the pterotic and opisthotic bones.

Turning to the ventral surface (fig. 1), we find the para-sphenoid and vomer, as in most fishes, form a complete median axis. A ridge runs out on either side of the posterior part of the para-sphenoid, dividing the ventral surface into orbital and auditory regions.

The two optic cavities are confluent, and the bones bounding them dorsally are fused, the ali-sphenoids (fig. 1, *al.s.*) meeting in the median line, and forming a very complete ventral wall to the cranial cavity, except for twolarge median for amina.

Other general features of the skull may be seen by an observation of figs. 1, 2, and 3.

The *cranium* is very much flattened dorso-ventrally in comparison with the cranium of allied forms, such as the mackerel and the perch. It is a very firm, solid, and heavy structure, and the texture and fusion of the bones remind one much more of a mammalian skull than that of the common piscine type (fig. 1).

The supra-occipital is a large bone which bears a flat prominent occipital spine (figs. 2 and 3, *s.o.*). This spine projects out horizontally well beyond the level of the occipital joint.

The basal part of the bone is wedged in between the epiotics and the parietals, and it has no connection whatever with the ex-occipitals, being excluded by the fused epiotics. This is caused by the shifting forwards of the supra-occipital (which is so common a feature in piscine skulls) to meet the frontals. In this case it is carried to such an extreme that, from above (fig. 3), this bone appears to complete the parietal ring. The same phenomenon holds to a great extent in the perch and its allies; whilst most Anacanthine fishes seem to present the more primitive feature of a pair of medially fused parietals, the supra-occipital being farthest back perhaps in the Cyprinoids. In the Clupeoids (herring), the supra-occipital is a mere rudiment. Between the parietals and the frontals the whole dorsal surface of the brain is entirely unprotected by osseous tissue, except for the fact that the supra-occipital growing forward to meet the frontals divides the space up into a median and two lateral foramina in such a manner (fig. 3) that the lateral foramina are bounded by the parietals, frontals, and supra-occipital, and the median foramen by the frontals and the supra-occipital. These three foramina are one of the most peculiar features of the skull, and though present in the genus they are entirely absent in the mackerel, and also in the perch and its allies. Owen speaks of Cobitis and Siluroids as having a large dorsal fontanelle, whilst in the herring there appear to be a pair of lateral but no median ones. It is difficult to see either the cause or the function (retained or lost) of these large dorsal fissures into the cranial cavity. It is worth noting that one of the median ventral fissures between the two ali-sphenoids (see below) is vertically exactly below the dorsal median foramen, so that in looking at the skull from above one can see down through the cranial cavity, on to the dorsal surface of the para-sphenoid.

The *ex-occipitals* (*ex.o.*) give off lateral wing-like processes which form part of the postero-dorsal wall of the capsule, and which fuse with the opisthotic laterally and with the pro-otic and epiotic in front.

They are, as usual, pierced by foramina for the exit of the vagus nerves. The axial part of the ex-occipitals surrounds the foramen magnum, and is continued on either side to meet dorsally and ventrally; thus, as in the herring for instance, completely excluding both the basi-occipital and the supra-occipital from participating in the formation of the walls of the neural tube. Owen draws a comparison between this arrangement and the downward growth of the vertebral neurapophyses in this and some other fishes. The former of these bones, however (fig. 2, *b.o.*), projects out posteriorly beyond the ex-occipitals, and here forms the base upon which rests the 1st vertebra.

The *basi-occipital* (figs. 1 and 2, *b.o.*) is a solid cubical bone which has the whole of its ventral surface covered over by the para-sphenoid. This latter bone is prolonged backwards in two wing-like processes exactly covering two similar processes of the basi-occipital (figs. 1 and 2). These enclose a large canal which, passing upwards and forwards through the basi-sphenoid, narrows into a median vertical slit which opens into the ventro-posterior part of the orbit. The dorsal wall of this canal is formed by processes of

the pro-otics. This sub-cranial canal is present in several important groups of fishes; according to Owen, in 'Salmonoids, Sparoids, and Scomberoids, and is very remarkable in most fishes with lofty compressed skulls as *Ephippus*.' In the herring there is only a deep groove formed, the fusion ventrally not being complete, whilst in the gadoids it appears to be entirely absent. It is apparently filled in life by some of the eye-muscles (Owen). The whole of the posterior surface of the basi-occipital is formed into a large occipital condyle; whilst on the lateral surface, facing upwards, are two facets for articulation with the zygapophyses of the 1st vertebra.

The Otic Bones.—The otic bones are all large and firmly fused together, forming a large proportion of the cranium. The *epiotics* (figs. 2 and 3, *ep.t.*) lie laterally to the supra-occipital; each consists of (1), a basal part forming part of the wall of the cranium, which is bent at an obtuse angle, so that the anterior portion forms part of the dorsal surface, uniting with the pterotic and the parietal, and its posterior smaller part, fusing with the ex-occipital, partakes in the formation of the sloping posterior surface; and (2) a projecting portion, whose edge is curved to form part of the rim of the large lateral basin described above, being directly continuous with a like ridge on the parietal and frontal. Resting just dorsal to this epiotic process is the attenuated upper fork of the post-temporal (fig. 3, *p.t.*). No articulation, however, seems to occur; a ligamentous connection is possible.

The *pterotics* (figs. 1, 2, and 3, *pt.t.*) are very large indeed, spreading over an immense area of the ventral surface (fig. 1), and having a very deep articular cavity for the head of the hyomandibular (fig 1, *p.h.f.*). The hyomandibular is double headed, the front fork running forwards and articulating in another cavity (*a.h.f.*), which is formed partly by the pterotic and partly by the sphenotic or post-frontal (Owen). These two cavities make a very firm attachment for the suspensorium described further below. The pterotic fuses with the sphenotic along the border of the post-orbital ridge. Posteriorly outwards the bone is flattened, and produced to form the prominent parotic process. In front it fuses with the frontal and parietal, with the sphenotic and pro-otic ventrally, posteriorly with the opisthotic, and internally with the epiotic and ex-occipital.

The *opisthotics* (petrosals) are very small bones (figs. 1 and 3, *op.t.*) behind the pterotics and between them and the ex-occipitals. They have a large articular process to which is attached the lower fork of the post-temporal, the pectoral arch being thus directly suspended from the skull by this articulation above, an articular attachment of the upper fork to the epiotic not taking place.

The *pro-otics* (ali-sphenoids) (fig. 1, *pro.t.*) are only seen on the ventral surface, lying between the ali-sphenoids (*al.s.*) in front, and the basi- and ex-occipitals behind; externally they form a part of the post-orbital ridge, and internally they form at the same time the base of the neural canal, and the roof of the sub-cranial canal. On their outer border they articulate with the opisthotic, sphenotic, and pterotic. They are large and very irregular in shape, the greater part of their surface lying in a horizontal plane, which corresponds to the usual type of pro-otics found in "low depressed skulls" (Owen). They are perforated by a foramen for exit of 2nd and 3rd branches of trigeminal nerve, thereby differing from the gadoids in which there is only a notch.

The *sphenotics* (post-frontals) (fig. 1, *pst.fr.*) are peripheral bones forming part of the dorsal wall of the optic cavity, together with the frontals and ali-sphenoids. Their posterior surface is raised to form the post-orbital ridge. Under this ridge the depression (fig. 1, *x.*) in the pterotic

is continued as a deep fossa, extending above the sphenotic and below the dorsal lamina of the frontal (see fig. 2).

The *para-sphenoid* is a long bone (figs. 1, 2, and 4, *pa.s.*) running along the whole base of the skull to the vomer in front, with which it is firmly fused. It has a median ridge on its ventral surface and is forked posteriorly, covering the basi-occipital, and taking part in the formation of the sub-cranial canal as already described. In front of the basi-occipital it supports the pro-otics, in front of which it rises in two lateral wings, and in a median pillar, which divides the mouth of the sub-orbital cavity into two. It bifurcates dorsally to join the two pro-otics. This median pillar is probably a separate ossification to the para-sphenoid, and represents the basi-sphenoid (Huxley). In the mackerel it is a distinct V-shaped bone, which separates from the para-sphenoid on maceration. Beyond this the para-sphenoid becomes perfectly free from the cranial basis, not in any part coming in contact with the ali-sphenoids which slope up and away from it in such a way (fig. 1) that the para-sphenoid stretches across entirely by itself separating the two orbits; fusing, however, with the lateral ethmoids and the vomer in front. This fact gives the cranium a very peculiar aspect, especially so when it is compared with that of the gadoids where the para-sphenoid actually takes part in the formation of the floor of the cranial cavity. A number of intermediate forms seem to exist between these two types.

The *ali-sphenoids* (orbito-sphenoids) (fig. 1, *al.s.*) are a pair of oblong plates, which, for an acanthopterous fish, are very large indeed, extending from the pro-otics behind to the lateral ethmoids (pre-frontals) in front, and fusing together by a median suture. They thus form the greater part of the cranial floor, and, as already remarked, they not only do not touch the para-sphenoid but are raised well above it. This complete basal wall to the cranial cavity is a very remarkable feature, and is one that is in accordance with other highly specialised characters of this fish. Between the ali-sphenoids and the pro-otics is a large median foramen (fig. 1, *for.* 1), and at their front end is a long slit-like median foramen (*for.* 2), already remarked upon as being directly below a similar foramen between the frontals.

The *parietals* (figs. 2 and 3, *par.*) are small and compressed antero-posteriorly; they are bent in a V-shape (lying horizontally), the upper wing entering into the formation of the lateral basin, and the lower into that of the dorsal cranial wall. They articulate normally with the frontals in front and the epiotics behind, and also touch the pterotic and supra-occipital.

The *frontals* are by far the largest bones of the cranium. They form a large part of the dorsal wall of the orbit (fig. 1, *fr.*), and also contribute to the lateral and dorsal walls of the cranium. They constitute the front two-thirds of the lateral basins, and their inner edges rise up close together to form a double median crest, as already described. Their dorsal surface towards the anterior end (fig. 3) is deeply corrugated.

Internally each frontal sends down a vertical longitudinal partition which divides the fore part of the cranial cavity into three,—a median part which opens above and below to the exterior, and two lateral chambers (which open dorsally in the lateral foramina). This structure of the frontals makes the passage from the dorsal median foramen to the ventral ali-sphenoid foramen (*for.* 2) even more striking than would otherwise be the case, for it thus appears to be lined with osseous walls everywhere, except posteriorly where it passes into the main part of the cranial cavity. in this connection we quote Owen:—'In the Salamandroid fishes (*e.g.*, 'Polypterus) each frontal sends down a vertical longitudinal plate, which 'rests directly upon the pre-sphenoid (para-sphenoid) and intercept

'canal along which the olfactory "crura" are continued forward to the 'pre-frontals; the lateral parietes of this canal thus form not only a 'complete but a double bony partition between the orbits. In the shad 'a corresponding descending plate takes the place of the orbito-sphenoid '(ali-sphenoid). *In most Acanthopteri an olfactory groove is formed by 'short vertical descending plates from the under surface of the frontal.*'

The tunny in this feature appears thus to conform to the typical structure of its allies, although to an exaggerated degree, in spite of the great differences in the ali-sphenoidal area. The frontals rest in front upon the mesethmoid, and join the lateral ethmoids, and behind they fuse with the parietals, supra-occipital, and sphenotic.

The *lateral ethmoids*, *pre-frontals* (fig. 1, *pre.fr.*), are distinct ossifications lying, as is usual, in front of the frontals and ali-sphenoids. Their ventral surface is mostly horizontal, and they fuse medially, but behind they curve downwards to form the front vertical boundaries of the orbit. They have two roughened articular surfaces to support the front end of the palatine, and are pierced by an olfactory foramen, surrounding also the olfactory cavity.

The *mesethmoid* (figs. 2 and 3, *mes.*), a conspicuous bone, lies above the vomer, presenting a smooth rounded surface on the dorsal end of the skull. It is heavy, broad, and deep, and divides the nasal cavities. On each lateral face is an articular depression to receive a condylar head of the anterior end of the maxilla.

The *nasals* (fig. 3 *na.*) are a pair of small oblong bones running forwards from the frontals and roofing in the nasal cavities.

The *vomer* (fig. 1 *vo.*) is of the usual shape, and fused with the parasphenoid and mesethmoid. It bears a median dentigerous area, and has a lateral depression on each side, in which are attached the ligaments to the head of the palatine. The *lacrymal* (ant-orbital) is a long oval bone (fig. 3 *s.or.*) which is articulated to the lateral ethmoid on either side.

Owen remarks upon the subject of sub-orbitals that they 'are occasion-'ally present in great numbers, as, *e.g.*, in the tunny.' There is no trace of any sub-orbital, except the lacrymal, in the specimen under observation; possibly they were lost in maceration.

The supra-temporals (fig. 3, *su.t.*) are a pair of superficial bones lying in the opercular region, and are of peculiar oval shape, with a very curious spine projecting downwards and forwards. Their normal position is over the opercular condyle.

The Cranial Cavity.—The cranial cavity is large, and its anterior end is modified in accordance with the peculiar dorsal and ventral foramina. In fig. 5 is seen a diagrammatic median vertical section through the cranium, the bounding bones being merely outlined as exactly as can be drawn from the specimen without sectionising. The course of the sub-cranial canal is also indicated. The front end of the cranial cavity ends in a vertical wall, and the olfactory nerves, doubtless, pass out through *for.* 2, to perforate the lateral ethmoid on either side, and thence into the nasal cavity.

Figs. 6 and 7 are diagrammatic representations of imaginary vertical transverse sections through the cranium at (*a*) and (*b*) respectively in fig. 5. In these are seen the vertical frontal partitions, the double frontal crest, the lateral depressions, and the median and lateral foramina.

The auditory chambers mostly bounded by the epiotic, pro-otic, and ex-occipital seem to communicate freely with the cranial cavity, and, as far as can been seen, the semicircular canals are normally situated.

The Arches.—The *premaxilla* (fig. 8, *pmx.*) is long and curved. The front end is expanded to a large nasal process, and is closely opposed to its fellow, but is not fused with it. Behind the head of the premaxilla

fits, by a bifurcation of its front end, the *maxilla* (figs. 4 and 8, *mx.*) This bone is also long and rib-like in shape, the similitude being completed by a condylar head at the front end which moves in a lateral depression of the lateral ethmoid (fig. 1). At its hind end is loosely attached a small flat triangular bone, which probably may be homologised with the jugal of other forms (figs. 4 and 8, *jug.*), a similar bone being found in such forms as the pike.

The maxilla and jugal are destitute of teeth, but on the ventral edge of the premaxilla is a single row of small teeth. These appear to be very small for a fish of such voracious habits and so great a size as the tunny. Considering that out of the stomach of this specimen itself were taken 'three haddocks (11, 11, and 9 inches), two lemon dabs (9¼ and 8¼ ' inches), and two common dabs (7½ inches),' it is a matter for surprise that it should be provided with teeth so few and so small. The teeth vary in shape between the two types portrayed (figs. 5*a*. and 5*b*.), are curved inwards, and imbedded in deep sockets. A great number of them are broken off short at the edge of the socket, and many of the sockets are now empty. Traces of 84 teeth can be found upon the left upper premaxilla here described, and about the same number on its fellow.

The teeth and empty sockets seem to alternate in a very striking manner. Cuvier gives the actual number of teeth as about 40.

The Palatine Arch.—The *hyomandibular* (fig. 4, *hym.*) is a large hammer-shaped bone, firmly articulating by its bifurcating head in depressions of the ventral surface of the pterotic already described. On the outer surface of the head is a condylar protuberance upon which the whole of the opercular plate moves, fitting as it does in a depression upon the inner surface of the opercular (fig. 3, *op.*). The axis of the hyomandibular is nearly perpendicularly downwards in its normal position, and its hind border is grooved for the reception of the pre-opercular. Its distal end is free, the symplectic not reaching up to it. The *metapterygoid* (fig. 4, *mt.pt.*), a flat square bone, grasps its front border, and in its turn fuses distally with the symplectic, quadrate, and pterygoid. From the outside of the skull the quadrate appears to be in the shape of a V, to one arm of which is attached the pterygoid laterally and the meta-pterygoid terminally, and between the arms lies the small symplectic (fig. 4, *sy.*). The other arm passes up outside the symplectic, and is grooved throughout its length for the reception of the pre-opercular.

At the apex of the V is the condyle for the reception of the mandible, which is so shaped to allow of only vertical movement.

The *pterygoid* (fig. 4, *pt.*) is of the usual type, and bears on its inner surface the *meso-pterygoid* (*ms.pt.*), a large plate-like bone which rests upon the para-sphenoid, and has along its centre a long dentigerous area, an exceptional position for such a structure.

The *palatine* (fig. 4, *pal.*) is bifurcated, one fork passing round the maxilla, and being fixed to the roughened surface of the head of the maxilla (fig. 8, *mx.*), the other fork passing ventrally to the maxilla, and being attached by strong ligaments to the side of the vomer (fig. 4), in a depression of which the ligaments take their origin. This fork bears a number of small teeth on its ventral surface, so that in the buccal cavity of the tunny are five dentigerous areas on the palate. One on the vomer, two on the palatines, and two on the meso-pterygoids, the latter being absent in most Acanthopteri. The dorsal surface of the palatine rests upon two roughened areas of the lateral ethmoid, which are seen in fig. 1. The whole palatine arch thus assumes a large V-shape, the apex of the V forming the articular condyle, and each arm of the V bifurcating in its turn. Thus the quadrate bears the symplectic, meta-pterygoid, and hyomandibular composing the posterior arm; the latter bone bifurcating, and each fork

being firmly imbedded in pterotic depressions. The anterior arm consists of the pterygoid, meso-pterygoid, and palatine, the last in its turn bifurcating, one arm being bound by ligament to the lateral ethmoid, and the other bound in two places to the lateral ethmoid, and in a third to the maxilla.

This doubly bifurcated osseous system makes all antero-posterior movement of the suspensorium impossible, and ensures a firm support for the mandible. The *mandible* (fig. 9) is very short, heavy, and powerful. The large forked *dentary* (*dē.*) bears a row of teeth precisely similar to those of the premaxilla, and there are traces of 86 in all upon the right ramus. It may be significant that the empty alveoli and perfect teeth alternate regularly at least in the front end of the mandible. It is possible that they are renewed regularly in alternate rows by vertical replacement.

The two *dentaries* are not fused, but joined by ligament. The *articular* is of the usual type, with a small *angular* (*ang.*) attached to its posterior angle.

The opercular bones form together a very large operculum which is attached by the front border of the præ-opercular to a groove in the hind border of the hyomandibular and quadrate.

The Hyoid Arch.—The hyoid apparatus is typical of the Acanthopteri (fig. 10). It has a peculiar, flat, spatulate glossohyal (fig. 10*a.*), and a long laterally compressed urohyal (*ur.*). There are four branchiostegal rays upon the ceratohyal, and three longer ones on the epihyal.

The *branchial arches* call for no comment, they are of the usual Acanthopteran type, and very closely resemble those of the perch.

The Pectoral Arch.—The pectoral arch consists of a powerful chain of bones which together assume a sickle shape (figs. 11 and 12). The *post-temporal* (*p.t.*) is forked as is usual, the upper branch being, however, thin, and just resting upon the epiotic process of the skull; whilst the main attachment to the skull is by the lower branch, which articulates firmly on a protruding knob of the opisthotic. The *supra-clavicular* (*s.cl.*) is short and broad, and fits into a fork in the lower border of the post-temporal; it appears to have segmented off its upper prolongation (*s.cl.*, 2), which, in the adult, lies quite apart, resting upon the inner edge of the post-temporal. The *clavicle* (*cl.*) is long and curved, its upper end joins the supra-clavicle. Arching round dorsally to the scapula it ends in a pointed process in front of the inter-clavicle. On its posterior border are articulated the *scapula* (*s.c.*) and the *coracoid* (*c.o.*). Between it and the scapula is a well marked scapular foramen (*s.f.*), and a similar but attenuated foramen, the coracoidal, stretching between it and the coracoid.

The lower end of the clavicle bends forward and inward, and comes to lie close to its fellow and to the urohyal, to both of which it is probably attached by ligaments, as in the cod. The edge of the clavicle is bent back so that a large deep groove is formed for the reception of the lateral trunk muscle. The scapula (*s.c.*) is small and fan-shaped, encroaching further upon the surface of the clavicle on its inner surface than on its outer. It fuses ventrally with the coracoid (*co.*) which sends down a long process extending forwards for some way, and joining the hind border of the clavicle.

There are, as is usual in the perch and other allies, two accessory bones, the inter-clavicle (*i.c.*) and the post-clavicle (*p.cl.*), both of somewhat indefinite shape. They lie internally to the scapula and coracoid, the inter-clavicle coming into close relation with the upper end of the clavicle, and the process of the post-clavicle projecting freely ventralwards.

There are three well ossified basalia (*b.* 1, *b.* 2, and *b.* 3), small cubical bones, one articulating with the coracoid and two with the scapula. To these and to the scapula itself, the rays of the pectoral fin are attached.

The Pelvic Arch.—The meta-pterygial bones, which usually do duty in the Teleostei for the pelvic girdle of the higher vertebrata, are in the tunny of very peculiar and modified form. Fig. 13 is the lateral view of the right meta-pterygium. On the inner face of the bone, opposite to the attachment of the pelvic fin, it articulates closely by a roughened surface with its fellow, although they are apart in the dried specimen. Posteriorly to this each tapers backwards into a styliform process (the terminal portion of which is detached from the rest as a free apophysis), lying in the abdominal wall, close to its fellow; and anteriorly each is produced into a broad, flat, blade-like process, which reminds one very much of the appearance presented by the scapula of some higher vertebrates. Below this blade each gives off a pair of long, thin, flat processes, one of which is longer than the other. These lie in the abdominal wall, close to the outer surface, and are slightly curved. The left meta-pterygium is markedly larger and longer than the right, the actual lengths of each, from tip to tip, being 20 inches and 21·5 inches respectively. This curious asymmetry is also found to a less extent in the pectoral girdle and in the skull, and is a not uncommon abnormality. This highly specialised 'pelvis' is a feature in which the tunny differs markedly from its close ally, the mackerel, in which it is of the normal reduced and undifferentiated teleostean type.

The Vertebral Column.—The vertebræ are 39 in number, and present some peculiar modifications. The 1st vertebra (figs. 14 and 15) is small and displaced dorsally, the centrum is either lost or not developed, the whole vertebra being simply a bony ring supporting a neural spine. It has two lateral processes looking ventralwards, which articulate with the lateral facets on the basi-occipital. Its spine is flat and long, and rests on that of the 2nd vertebra.

The whole vertebra is held firmly in the fronto-dorsal part of the 2nd vertebra, assisted by a pair of articulating anterior zygapophyses upon the latter.

A very long thin 'rib' is articulated by its head to a small transverse process on either side of the 1st vertebra (fig. 15).

The 2nd vertebra (fig. 14) has a large centrum, the front concave surface of which articulates with the posterior face of the basi-sphenoid. It has an anterior zygapophysis, with a facet looking inwards, as already described, and a posterior zygapophysis, with its facet also looking inwards. It bears a pair of 'ribs,' the dorsal one attached to the ventral, and both attached to the lateral surface of the centrum. Its neural spine is flat, long, and pointed, and fused to that of the 1st vertebra.

The subsequent changes of the 'ribs' in shape and mode of articulation as one passes to the posterior end of the body are very instructive. Figs. 15 to 20 are diagrammatic representations of some of the vertebræ and the articular ends of the 'ribs.'

It will be here seen that the two 'ribs' are articulated laterally, and in close proximity in the 2nd to 6th vertebra (figs. 16 to 20); but that a hæmal process then grows out from the 7th (fig. 17) onwards, and the ventral 'rib' shifts its point of attachment to the distal end of this process. Thus, in the 7th and 8th vertebræ, the dorsal and ventral 'ribs' at their origin become further apart. The hæmal processes of each side, at first, point downwards and forwards, as in fig. 14, but further back they incline to the vertical, and later (fig. 20) they point downwards and backwards, and, finally, in the caudal vertebræ, come to be completely horizontal (fig. 21). Concurrently with these changes the hæmal processes of each side approach one another in the middle line; and eventually, from the 10th vertebra (fig. 19) onwards, they completely fuse

and form a hæmal spine, to the distal end of which are still attached a pair of ventral 'ribs' (fig. 20).

These hæmal processes arise from the front end of each vertebra, and from the 16th vertebra onwards there arises from the base of each process a small knob which articulates with a like process from the posterior ventral surface of the preceding vertebra. These inter-central articulations, like their zygapophysial homologues dorsally, continue backwards throughout the column from the 16th to the 37th vertebra.

The dorsal 'ribs' gradually slope upwards and shorten till they come to be mere short spines protruding laterally and horizontally from each vertebra; still, however, having a definite articulation with the centrum.

The ventral 'ribs' follow a very irregular mode of structure, and assume all sorts of shapes and positions, from the long styliform processes of the 1st and 2nd to the curved, flat, sabre-shaped 'ribs' of the 5th to 9th. The general disposition of these is seen in fig. 14.

Proceeding backwards they gradually become reduced in size, and fused together till at last they form simple continuations of the hæmal spines, and further back are lost altogether. Appearances seem to point to the view that the ribs really become fused with the hæmal arch, a mere trace of them being found right up to the 31st vertebra, where the hæmal processes themselves become remarkably modified into flat plates.

In all the vertebræ the ribs take no part in the formation of the hæmal arch proper, but remain as a fused spine. These ventral ribs line the inner wall of the abdominal cavity, and are doubtless homologous with the true ribs of allied forms.

The dorsal ribs (fig. 14) arise in the 2nd vertebra as exactly similar structures, and in close contiguity to the ventral ribs (fig. 14). Passing backwards they retain their lateral attachment to the vertebræ, and, becoming short, thick, rod-like structures they persist right to the 33rd vertebra. In the 34th they either atrophy, or are fused in the curious lateral keel here developed. These dorsal 'ribs' appear to lie in the myocommata, between the dorso-lateral and ventro-lateral muscles. They are all articulated to the vertebræ, never fused with it; and there is, except in the very front ones, a double vertically forked head, so that antero-posterior horizontal movement is easy, but dorso-ventral motion is impossible. These 'ribs' in no case appear to be of the nature of offshoots (or epipleura) of the ventral ones, and it is to be noted that in position, function, shape, and mode of articulation they differ markedly from the latter.

At the 33rd vertebra first appears the lateral osseous crest supporting the 'keel' (fig. 21). This crest is largest in the 34th, tapers on the 35th, and disappears on the 36th. The anterior and posterior edges of these crests are not fused, but are in close contiguity, and doubtless serve the purpose of strengthening the column against horizontal strains. In these vertebræ (34th and 35th) the neural and hæmal arches are flat horizontal plates, which grasp the dorsal and ventral surfaces of the following vertebra so firmly that the 34th, 35th, and 36th cannot be separated without fracture (fig. 22). The centra are more or less cubical, and the three vertebræ form a compact mass for the support of the powerful tail. The vertebræ, before the 34th, show a complete transition from the stage in which the neural and hæmal arches function for the support of the dorsal and ventral finlets, to that in which they function as in the 34th and 35th. The 36th is firmly clasped by the arches of the 35th, and its arches are thick strong rods passing outwards obliquely, and supporting the caudal rays. The 37th, 38th, and 39th have very compressed centra, with arches also supporting the caudal rays. A very large triangular urostyle bears the remainder of these.

The Fin-Rays—Paired Fins.—The pectoral fins are large and long, the left apparently bearing 33 rays, the first two of which are spiny and strong. They are all double, and the two halves separate proximally into a fork. The 4 anterior rays are attached to the scapula (fig. 11), and the rest to the 3 basalia. The bases of the rays overlap each other, forming a powerful junction between them. The right pectoral fin bears 30 rays.

The *pelvic* fins are long, and each bears 6 rays, the first of which is spiny (fig. 13). They are articulated in a fairly deep depression in the pelvis, and overlap each other in the same way as do the pectoral.

Median Fins and Finlets—Dorsal.—The first dorsal consists of 13 fin rays which are attached to broad plate-like interspinous elements by a hinge joint, allowing free antero-posterior movement by which the spines may be folded into a hollow. The interspinous elements are supported at their proximal extremities by the neural spines of the dorsal vertebræ. All the rays are of the spinous character, none being split up into jointed rays.

The second dorsal is smaller, and consists of 12 rays, each having an interspinous element, and the first two are spiny, the rest partaking of the 'soft' type. The interspinous bones are crowded close together so that they lie dorsally to only two neural spines, those of the 22nd and 23rd vertebræ. The dorsal finlets, ten in number, are evidently each of the character of dorsal fin-rays which have become separated, and have taken on a compressed broad shape; they are attached by interspinous elements, one to each neural arch, to the 23rd to 32nd vertebræ inclusive.

Nine precisely similar finlets are found on the anal ridge, though two have been lost in this skeleton; they are also attached in the same way to the hæmal spines of the 24th to 32nd vertebræ inclusive, and the first of these is very similar in appearance to the last anal ray.

Anal.—The anal fin has 11 rays, the first two of which are spiny; the interspinous elements are compressed to cover the area comprised by the 20th to 24th vertebræ, so that here less concentration has taken place than in the dorsal fin. It is worth noting that the total number of dorsal fin-rays and finlet-rays is 35, or exactly the same number as the vertebræ, leaving out the four last, the neural spines of which bend back to bear the rays of the tail.

Caudal.—The tail is homocercal, and is composed of 45 rays which are attached to the neural and hæmal arches of the 36th, 37th, 38th, and 39th vertebræ by double heads. The urostyle is very large and solid. The shape of the tail is of a pronouncedly forked type, such as is found in its ally the sword fish, and, as Owen points out is modified for great velocity.

The fin-ray formula for this specimen will thus be as below. The same formula is given, for comparison, of the tunny in the Edinburgh Museum, and also the formula as stated by Cuvier.

	Dorsal 1st.	Dorsal 2nd.	Dorsal Finlets.	Anal.	Anal Finlets.	Caudal.	Pectoral.	Ventral.
St Andrews, .	13	12	10	11	9	45	33–30	6–6
Edinburgh, . .	14	14	9	13	9	?	?	6–6
Cuvier, . . .	14	14	9	14	8	35 or 36	31–31	6–6

This discrepancy is not so great when it is observed that the point as to whether to regard the last dorsal ray as a finlet or not, accounts for

one disagreement, and the same with the 1st anal finlet. The pectorals and caudals, however, show a great divergence in point of number. If we include the finlets in their respective fins, we may give an approximate formula:—D.1, 14; D.2, 22; A. 22; C. 36 to 45; P. 30 to 33; V. 6. This may be compared with Cuvier's formula for the mackerel:—D.1, 12; D.2, 17; A. 18; C. 33 to 35; P. 19; V. 6.

Comparison with the Mackerel, &c.—Taken as a whole the resemblance between this skeleton and that of the mackerel is very close, although the tunny shows some remarkable differences in the greater elaboration of its parts.

In the skull the mackerel has no dorsal foramina, the frontals being solid and fused with each other in the median line, and posteriorly with the supra-occipital and the parietals. The dorsal surface is flat, except for the occipital spine, and there are no lateral depressions formed.

The ali-sphenoids are very small, and do not extend to the lateral ethmoids, forming very little of the cranial ventral wall. Thus, in the inter-orbital region, the frontals fuse medially to form a great part of the dorsal wall of the orbit.

The nasals are longer and more slender, and the mesethmoid has two anterior processes. The vomer has a pair of lateral dentigerous areas, and no teeth arranged medially.

If we allow for a change of shape due to the tunny's peculiar mid-cranial modification, as above mentioned, the rest of the skull is in close agreement.

The teeth are rather larger in proportion in the mackerel, and the 'pelvis' is of the simple type usually found in Teleostei.

The opercular, hyoid, and branchial bones are precisely alike, as is the pectoral arch. The number of fin-rays is invariably less in the mackerel, except in the ventral fin, where they are in equally small numbers. The tail of the mackerel is not so forked, being more of the truncate triangular type.

The fact that in its whole structure the tunny shows an elaboration of the mackerel type agrees with what we also find in the anatomy of this fish, and this may perhaps be partly accounted for by the excessive bulk of the body, in that in so large an animal the cells come into contact with complicated interactions, and complex environmental surroundings, which a smaller species would not experience. We should, generalizing from this, look to the larger species of a genus for the more elaborated structures, and in some groups of animals this is certainly the case.

The reverse of this principle is, of course, the well known degeneration or simplification of structure, concurrent with a reduction of size.

I here take the opportunity to record my best thanks to my friend, Professor M'Intosh, to Professor Bell and Mr Boulenger of the British Museum, and to Mr E. Clarke of the Edinburgh Museum.

EXPLANATORY LETTERS.

a.h.f.	anterior hyomandibular foramen.	*b.r.*	branchiostegal rays.
al.s.	ali-sphenoid.	*ce.*	ceratohyal.
ang.	angulare.	*cl.*	clavicle.
art.	articulare.	*co.*	coracoid.
*b.*1–3.	basalia.	*d.*1–8.	dorsal ribs.
b.o.	basi-occipital.	*de.*	dentary.
		ep.	epihyal.

PLATE XI.

Fig. 2

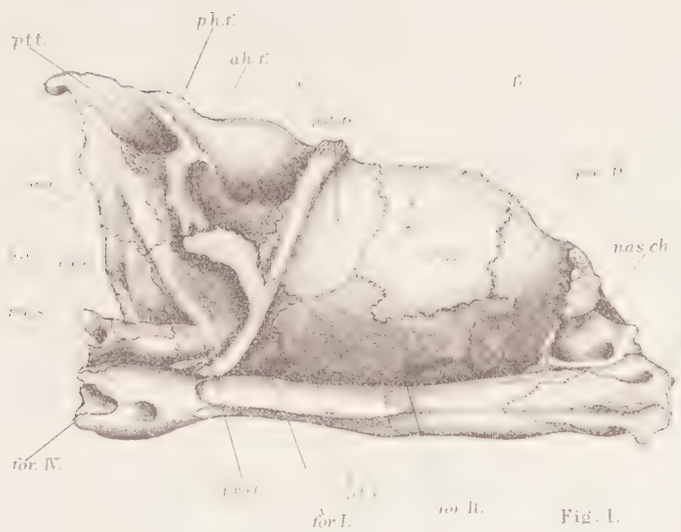


Fig. 1.

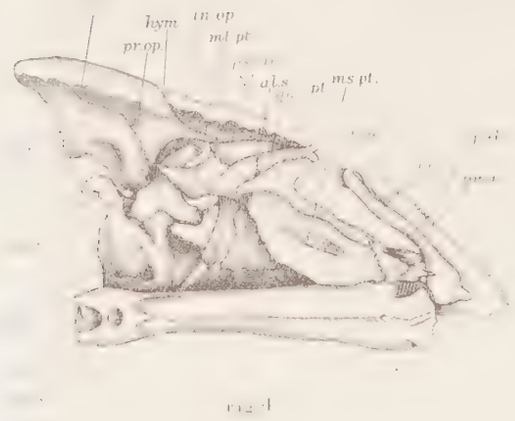


Fig. 4

Fig. 5

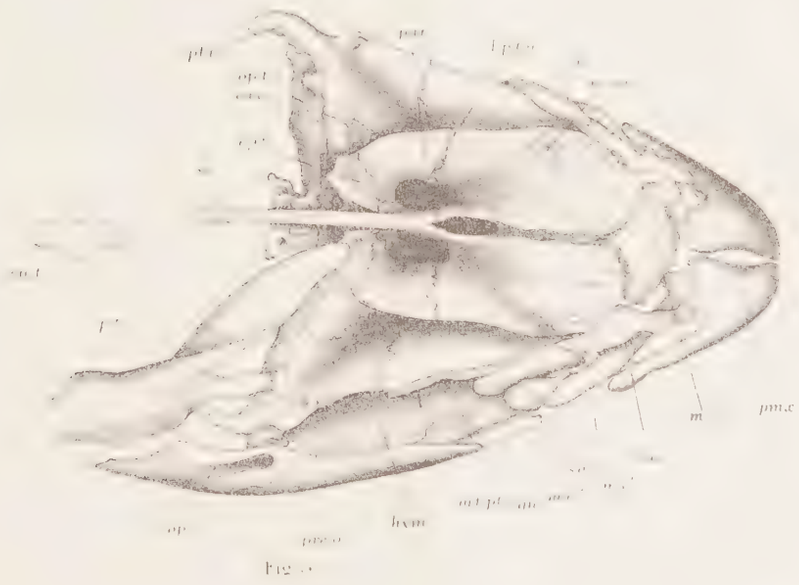


Fig. 6

Fig. 7

Fig. 8

Fig 9

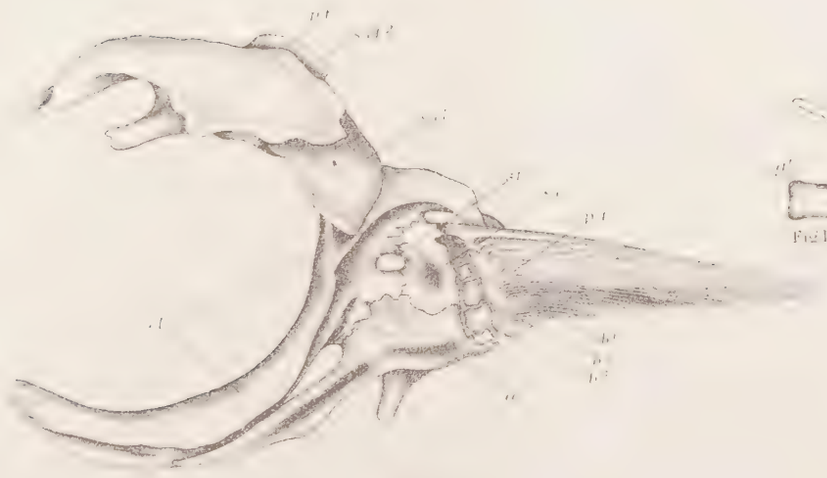


Fig. 11

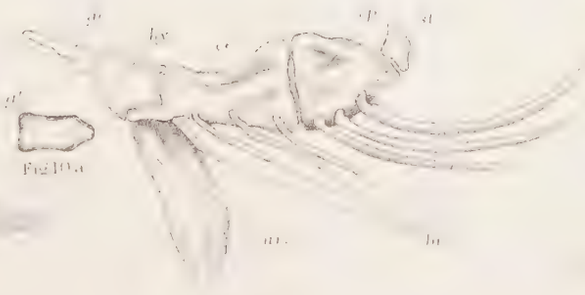


Fig. 10

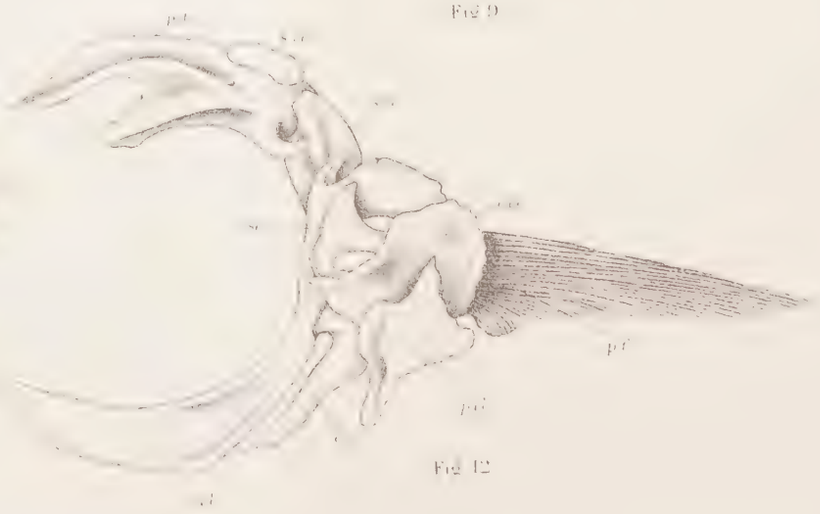


Fig. 12

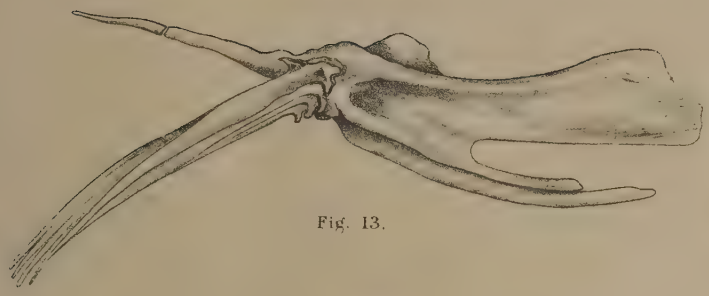


Fig. 13.

Fig18.

Fig15.

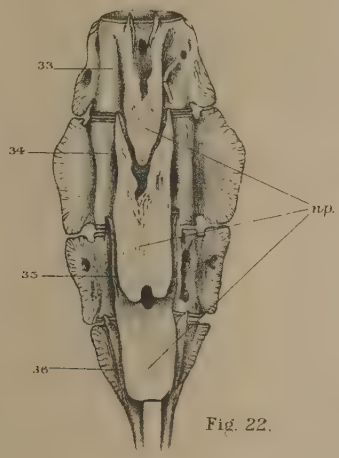


Fig. 22.

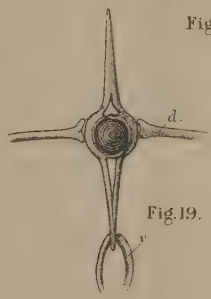


Fig.19.

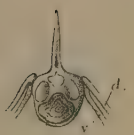


Fig.16.

Fig 17.

Fig.21.

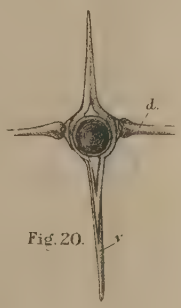
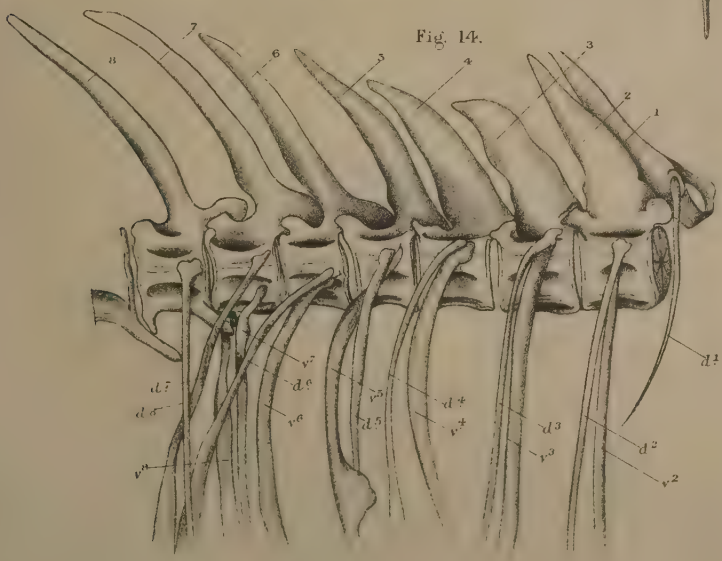


Fig.20.

Fig. 14.



ep.t. epiotic.
ex.o. ex-occipital.
for. 1. median foramen.
for. 2. „ „
for. 4. sub-cranial foramen.
fr. frontal.
gl. glossohyal.
hy. hypohyal.
hym. hyomandibular.
i.cl. inter-clavicle.
in.op. inter-operculum.
jug. jugal.
l.p.for. lateral parietal foramen.
mes. mesethmoid.
m.for. median foramen.
ms.pt. meso-pterygoid.
mt.pt. meta-pterygoid.
mx. maxilla.
na. nasal.
nas.ch. nasal chamber.
n.p. neural processes.
op. operculum.
op.t. opisthotic.
p.f. pectoral fin-rays.
p.h.f. posterior hyomandibular foramen.
pal. palatine.
par. parietal.
pa.s. para-sphenoid.
p.cl. post-clavicle.
pre.fr. pre-frontal.
pre.o. pre-operculum.
pro.t. pro-otic.
pst.fr. post-frontal.
p.t. post-temporal.
pt. pterygoid.
pt.t. pterotic.
qu. quadrate.
sc. scapula.
s.cl. supra-scapula.
s.f. scapular foramen.
s.o. supra-occipital.
s.op. sub-operculum.
s.or. sub-orbital.
s.t. supra-temporal.
s.t. stylohyal.
sy. symplectic.
ur. urohyal.
*v.*1–8. ventral ribs.
vo. vomer.
x. post-frontal fissure.

LIST OF FIGURES.

(Plates XI., XII.)

Fig. 1. Ventral view of cranium (nearly median).
Fig. 2. Side view of cranium (right).
Fig. 3. Dorsal view of skull (nearly median).
Fig. 4. Ventral view of skull, with mandible removed.
Fig. 5. Diagram of median vertical section of cranium.
Fig. 6. Diagrammatic section through (*a*), in fig. 5.
Fig. 7. Diagrammatic section through (*b*), in fig. 5.
Fig. 8. Front view of upper jaw and teeth.
Fig. 8*a*. and 8*b*. Teeth.
Fig. 9. View of lower jaw, inner surface.
Fig. 10. Lateral view of hyoid arch (left side).
Fig. 10*a*. Surface view of glossohyal.
Fig. 11. Anterior view of left pectoral arch.
Fig. 12. Posterior view of right pectoral arch.
Fig. 13. Lateral view of right 'pelvic arch' and fin.
Fig. 14. Lateral view of first 8 vertebræ and ribs.
Fig. 15. Anterior view of 1st vertebra.
Fig. 16. „ „ 2nd „
Fig. 17. „ „ 7th „
Fig. 18. „ „ 9th „
Fig. 19. „ „ 10th „
Fig. 20. „ „ 19th „
Fig. 21. „ „ 34th „
Fig. 22. Dorsal view of 33rd–36th vertebræ.

IV.—THE INVERTEBRATE FAUNA OF THE INLAND WATERS OF SCOTLAND.—PART IV. By Thomas Scott, F.L.S.

In this Report on the invertebrate fauna of the inland waters of Scotland, I propose to describe, first,—the results of a partial examination of Loch Tay in Perthshire; and second,—the results of the examination of tow-net gatherings and other material from certain Sutherlandshire lochs, collected, and forwarded to Dr Fulton, the Superintendant of Scientific Investigations, by W. S. Caine, Esq., M.P.

1.—Loch Tay, Perthshire.

Introductory.

Loch Tay belongs to the Marquis of Breadalbane and is one of the best salmon lochs in Britain.

The district about Loch Tay is known to botanists throughout the length and breadth of the land, as one of the richest in native alpine and sub-alpine plants, in the British Islands; some of the rarest of our native ferns, mosses, lichens, as well as flowering plants, have been and may still be obtained among the gullies and rocky crevices about the summits of Ben Lawers and the neighbouring mountains, and every year people interested not only in the British flora but in other departments of natural history as well are frequent visitors in the district.

Though Loch Tay and its surroundings are thus well known not only to the mere pleasure seeker but also to the naturalist, no systematic attempt has apparently been made hitherto to investigate the invertebrate fauna of the loch, and the present contribution toward that object may, therefore, be of interest.

It was during a short visit to the beautiful and picturesque village of Kenmore, in September last year, that I had the privilege of making a partial investigation of this fine Perthshire loch. Owing to the limited time at my disposal I was only able to examine that portion of the east end of the loch extending from the East Bay where the steam-boat wharf is, westward to near Fernan. There are two islands at this end of the loch—the 'Ministers Island'—which is little more than a cairn of stones; and Aidan's Isle or the Isle of Loch Tay.' King Donald IV. was drowned somewhere in the vicinity of Aidan's Isle; and here Sibylla—Alexander's Queen—died, and was buried A.D. 1122.

Depth of Loch Tay.

I was unable from want of time to take soundings of the loch, but the following notes from a paper read at a meeting of the Royal Society of Edinburgh, February 20th, 1888, by Mr James S. Grant Wilson of H.M. Geological Survey, may not be out of place. Mr Wilson's paper described the results of a recent bathymetrical survey of the chief Perthshire lochs and their relation to the glaciation of the district, and was illustrated by a carefully prepared chart of the various lochs referred to.* In this paper Mr Wilson describes Loch Tay as being 14½ miles in length by about ¾ of a mile in average width; the surface level of the

* This paper was published in the *Scottish Geographical Magazine* for May 1888.

water, calculated from the bench mark on Kenmore Bridge, is found to be 346 feet above the sea. The general outline of the loch somewhat resembles the letter S in form but with the ends only slightly curved. The lower portion of the letter is represented by the part from Killin to Ardionaig and extends E. 25° N. about 5½ miles, the middle portion is represented by the part from Ardionaig to Fernan and extends N. 30° E. about 5¾ miles, and the upper portion is represented by the part extending from Fernan to Kenmore, and which lies in the same direction as the west end, viz.,—E. 25° N. The length of this portion is about 3½ miles. The deepest part of the loch is opposite Skiag, or a little over 5 miles in a 'bee line' from Kenmore; the depth here is 85 fathoms or 520 feet. From this deep part of the loch the bottom rises gradually but more or less irregularly towards each end. When the loch is standing at its summer level the western margin is often covered with thin patches of bright red sand which, on examination, is found to be composed almost entirely of minute fragments of garnets; numerous fragments of garnetiferous schist may also be obtained scattered about the shore at the east end of the loch.

Invertebrate Fauna of Loch Tay.

The Loch was examined by means of a tow-net worked from a rowing boat kindly placed at my disposal by a friend in Kenmore. No examination was made of the bottom of the Loch except where the water was shallow, that is between the steam-boat pier and the 'Minister's Island' on the south side, and from Aidan's Isle eastward on the north side. Pelagic crustacea were scarce in all the surface and under-surface gatherings, but they included one or two forms of interest, such as the curious *Bythotrephes* and the beautiful *Leptodora*. On the other hand, the material collected by dragging the tow-net through and among the bottom vegetation found growing in some of the shallower parts and especially in the vicinity of the 'Minister's Island' proved to be rich in micro-organisms; over twenty species of crustacea were obtained in this way. Several species of Mollusca, Coleoptera, Arachnida, the larvæ of dragon-flies and other insects, Rhizopoda, Rotifera, &c. were also observed in the same material. In the following lists I propose to give a record only of the species of Mollusca and Crustacea obtained.

THE MOLLUSCA.

Comparatively few species of *Mollusca* were observed in Loch Tay, and this paucity of molluscan species corresponds with what I have observed in the investigation of other deep fresh-water Lochs; the conditions physical or otherwise of such lochs do not seem to favour the development of the *Mollusca*.

1. Lamellibranchiata.

Pisidium pusillum (Gmelin).	Frequent.
„ *fontinale* (Drapo).	Scarce.

2. Gasteropoda.

Valvata piscinalis (Müller).	Frequent, but generally of small size.

CRUSTACEA.

The crustacea obtained were not only numerous, especially in the bottom material, but included several comparatively rare and interesting species.

1. Copepoda.

Diaptomus gracilis (G. O. Sars).	Frequent.	in tow-net gatherings.
Cyclops signatus, Koch.	Few.	in bottom material.
„ *strenuus*, Fischer.	Few.	in tow-net gatherings.
„ *viridis* (Jurine).	Few.	in bottom material.
„ *serrulatus*, Fischer.	Frequent.	
„ *magnotavus*, Cragin.	Very rare.	
„ *macrurus*, G. O. Sars.	Rare.	
„ *fimbriatus*, Fischer.	Frequent.	
Attheyella crassa (G. O. Sars).	Frequent.	
„ *pygmæa* (G. O. Sars).	Few.	

2. Ostracoda.

Cypria serena.	Few.	in bottom material.
Cyclocypris globosa.	Few.	
Candona candida.	Few.	
„ *lactea.*	Few.	

3. Cladocera.

Sida crystallina (Müller).	Scarce.	in surface and under-surface tow-net gatherings.
Daphnia jardinii, Baird.	Frequent.	
Bosmina longirostris (Müller).	Frequent.	
Ilyocryptus sordidus (Lievin).	Rare.	in bottom material.
Acroperus harpæ, Baird.	Few.	
Eurycercus lamellatus (Müller).	Frequent.	
Camptocercus macrurus Müller).	Few.	
Alonopsis elongata, G. O. Sars.	Frequent.	
Alona quadrangularis (Müller).	Frequent.	
Pleuroxus trigonellus (O. F. Müller).	Scarce.	
Graptoleberis testudinaria (Fischer).	Scarce.	in tow-net gatherings and in bottom material.
Alona guttata (G. O. Sars).	Frequent.	in bottom material.
Chydorus sphæricus (Müller).	Frequent.	in bottom material.
Polyphemus pediculus (Linné).	Frequent.	in surface and under-surface tow-net gatherings.
Bythotrephes longimanus, Leydig.	Not common.	
Leptodora hyalina, Lilljiborg.	Moderately frequent.	

2.—Report on Tow-net and other Material from certain Sutherlandshire Lochs, collected and forwarded by W. S. Caine, Esq., M.P.

Introductory Note.

The material so kindly forwarded by Mr W. S. Caine, and which on examination proved of considerable interest, comprised tow-net gatherings, samples of aquatic plants, and trout and trout's stomachs from Loch Mullach Corrie (Maol a Choire); samples of aquatic plants and trout and trout's stomachs from Loch Awe; and trout and trout's stomachs from Loch Assynt.

These lochs are all in the district of Assynt, Sutherlandshire.

Mr Caine when he forwarded the material, sent also at the same time a short and graphic description of Loch Mullach Corrie and of Loch Awe, as well as a sketch of each of these two lochs to illustrate some of the points referred to in his description, and as the description and sketches are of interest they are reproduced in the sequel.

In the following remarks the lochs are noticed in the order in which they are referred to above.

First.—Loch Mullach Corrie (Maol a Choire).

This is a small loch and is situated in a limestone district about $2\frac{1}{2}$ miles from Inchnadamph Inn. Loch Mullach Corrie is reported to contain what are called 'Gilleroo' or 'Gizzard' trout, though some writers are inclined to question this, but be that as it may, the beauty of the coloration and of the form of the Loch Mullach Corrie trout are undoubted and their edible qualities are also reported to be excellent.

Description of the Loch.

Mr Caine's description of loch Mullach Corrie is as follows:—'The 'loch is commonly known as the "Gilleroo" Loch because it contains '"Gilleroo"trout. No one is able to explain how they came there; they 'are said to be the only trout of their kind found in Scotland, though 'very abundant in Irish lakes, especially in West Meath. The loch is 'about 5 furlongs in length by $2\frac{1}{2}$ furlongs in width. I have sounded 'its depth in 35 places; in a direct line through its length, in the 'middle; and in two direct lines across, at equal distances apart (as 'shown in the sketch—fig. 1). Along the length the soundings are 3 'feet, $4\frac{1}{2}$, $4\frac{1}{2}$, $4\frac{1}{2}$, 5, $5\frac{3}{4}$, $5\frac{1}{2}$, 6, 6, 6, $5\frac{1}{4}$, 5, $4\frac{3}{4}$, $4\frac{1}{2}$, and $4\frac{3}{4}$ feet. Across 'the first line (*a*) the soundings are $6\frac{1}{2}$ feet, 9, 8, 6, 6, $5\frac{1}{4}$, $5\frac{1}{2}$, 5, and $4\frac{3}{4}$ 'feet. And across the second line (*b*) 4 feet, 6, $5\frac{3}{4}$, $5\frac{3}{4}$, $5\frac{1}{2}$, $5\frac{1}{2}$, $5\frac{1}{2}$, 6, '$6\frac{1}{4}$, 6, and $3\frac{1}{2}$ feet; so that the average depth of the loch is about '$5\frac{1}{2}$ feet. The bottom, round the edges, is gravel and stones; along one 'side the stones and gravel are clean and bright, along the other side 'they are covered with a slimy vegetable deposit. The bottom of the

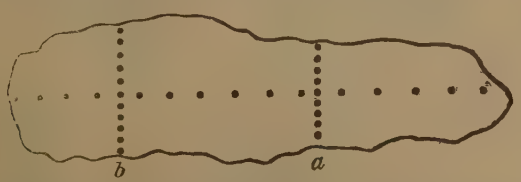


Fig. 1.]

'basin of the lake is soft black mud . . . from this mud spring dense 'masses of weed of three varieties. The loch is fed with spring water,

'and is very pure and transparent. There are large quantities of fresh-'water shrimps (*Gammarus pulex*) all over the loch,—among the gravel, 'under stones, and sticking to the weeds. Leeches are also very 'abundant, but I do not find fly-life very plentiful. There are a great 'quantity of curious gelatinous substances adhering to stones and lying 'about in the gravel shoals which I never noticed before in any lake."

The crustacean fauna of the little loch, to judge from the tow-net gatherings sent to me, is evidently very abundant and very interesting. One of the Copepods from this loch—*Diaptomus serricornis*—is new to the British Islands. Since the discovery of *Diaptomus serricornis*, Lilljeborg, in Loch Mullach Corrie it has been ascertained that the same species was found by Mr David Robertson of Millport many years ago (1867) in a pond near Lerwick, Shetland, but had remained unnoticed in print till the discovery of the species in the Sutherlandshire loch. A variety of *Daphnia pulex* (Linné), having the distal half of the hairs on the antennules and also the posterior spine of a black colour, was frequent in the tow-net gatherings from Loch Mullach Corrie; I propose to call this variety *nigrispinosa*. The 'shrimp' (*Gammarus pulex*, Linné) which Mr Caine describes as abundant in the loch is an evidence of the purity of the water. This is a species that can only thrive in water that is more or less pure; if transferred to impure water it very soon sickens and dies. The leeches, referred to in the description of the loch, belong to the genus *Hæmopsis* (the horse-leech) which is found in ponds and ditches all over the country. Seven stomachs of trout from this loch were sent by Mr Caine and they all contained *Gammarus* in greater or fewer numbers, in one or two of the stomachs there were along with the *Gammarus* a few insects, or portions of insects, chiefly of the *Phryganeidæ*. The plants that were forwarded comprised specimens of a species of *Chara*; of *Fontinalis antipyretica*, —a moss common in some fresh-water streams and shallow lakes; of *Littorella lacustris*; of *Menyanthes trifoliata* (the Bogbean); of *Millifolium spicatum* (water-milfoil); and a species of *Potamogeton*, or pond-weed. Among the animal organisms specimens of the curious little so-called 'water-bears' (*Tardigrada*) were observed specimens of insects chiefly of the *Phryganeidæ* and *Coleoptera*, specimens of the *Hæmopsis*, already referred to, and the following crustacea were also obtained.

AMPHIPODA.

Gammarus pulex (Linné).	Abundant.

COPEPODA.

Diaptomus serricornis, Lilljeborg.	Frequent.
Cyclops signatus, Koch.	Few.
,, *thomasi*, Forbes.	Few.
,, *virides* (Jurine).	Few.
,, *serrulatus*, Fischer.	Few.
,, *affinis*, G. O. Sars.	Few.
Attheyella crassa (G. O. Sars).	Few.

CLADOCERA.

Daphnia pulex (Linné).	Frequent
,, ,, var. nigrispinosa.	Frequent.
Bosmina longirostris (Müller).	Frequent.
Alonopsis elongata, G. O. Sars.	Few.
Alona quadrangularis (Müller).	Few.
Graptoleberis testudinaria (Fischer).	Few.
Chydorus sphæricus (Müller).	Frequent.

Second.—Loch Awe.

This is a small loch about four miles from Inchnadamph and nearly equidistant from Inchnadamph and Altnacealgach. The River Loanan flows out of this loch into Loch Assynt. The trout in Loch Awe are usually not very large—their average weight being about the one-third of a pound, their flesh is red coloured, and they are said to be of good quality. There are a number of small islands in the loch, most of them are situated near the middle, and so arranged as to divide the loch into two nearly equal portions. The loch is shallow and in some places is much overgrown with aquatic vegetation. Samples of the more common plants growing in Loch Awe were sent along with the material from Loch Mullach Corrie, they comprised specimens of *Littorella lacustris*, *Millefolium spicatum*, *Juncus bulbosus*, and of two species of *Potamogeton*. No tow-net gatherings were sent from this loch, but the following three species of crustacea were obtained by an examination of the plants mentioned above, viz.,—*Sida crystallina*, *Daphnia*, sp. (*? pulex*), and *Attheyella crassa*. A specimen of *Lernentoma* was obtained attached to the gills of one of the trout from this loch.

Twelve stomachs of trout from Loch Awe were examined, three of them were found to be empty; six contained the remains of insects only; two, the remains of insects and *Gammarus*; and one, the remains of the larvæ and larvæ-cases of 'Caddis-flies' (Phryganeidæ.)

Description of Loch Awe.

Mr Caine describes Loch Awe as follows:—'This is a small loch about 'three quarters of a mile long by a quarter of a mile wide, it is divided 'into two parts by a chain of wooded islands with stoney and gravelly 'beaches. The depth of the loch over all is from 5 to 7 feet at 'the distance of about 20 feet from the shelving margin. The two 'ends have stoney bottoms, quite clear of weeds for about one-third to 'one half of their area, and the shore round the islands is also free of 'weeds. There are practically two great beds of weeds—one across the 'middle of each of the two portions of the loch—which I have shaded 'on the rough sketch (from memory) given below; these weeds are the 'same growth—three varieties—as those I have sent from the "Gilleroo" 'loch, which is two and a half miles distant from Loch Awe.' Fig. 2 'is the sketch of the loch referred, showing the beds of weeds at W.W.

Fig. 2.

Third.—Loch Assynt.

This loch, well known to the angler for the excellent sport it furnishes, is of considerable area, being about eight miles in length by one mile in

breadth. Several streams, including the Loanan from Loch Awe, flow into it, and the River Inver, which, after a run of about 6 miles, falls into the sea at Loch Inver, flows out of it. Loch Assynt contains salmon, sea trout, common trout, and *Salmo ferox*—a variety of *Salmo fario*. No tow-net gatherings nor samples of acquatic plants were sent from this loch, but judging from the number and excellence of the fish contained in the loch its invertebrate fauna must be abundant, an investigation of which might be expected to yield interesting results. Twelve stomachs of trout from this loch were examined and were found to contain numerous insect and crustacean remains as shown by the following tabulated statement of the results of the examination.

Table showing the results of the examination of twelve stomachs of trout from Loch Assynt :—

No. of stomach.	Contents of stomach.
1	Remains of larvæ and larvæ-cases of 'Caddis-flies.'
2	Several specimens of *Valvata piscinalis* (a fresh-water mollusc).
3	Remains of *Limnæa peregra*, *Gammarus*, and larvæ-cases of Caddis-flies.
4	Remains of insects—species doubtful.
5	*Limnæa peregra*, *Gammarus*, remains of insects.
6	The same as 5.
7	*Valvata piscinalis*, elytra and other parts of beetles (*Coleoptera*).
8	*Valvata piscinalis*, and remains of insects.
9	Several *Limnæa peregra*, and larvæ-cases of 'Caddis-flies.'
10	One *Limnæa peregra*, remains of *Gammarus*, and 'Caddis-flies.'
11	Two *Limnæa peregra*.
12	Remains of *Gammarus*, and larvæ and larvæ-cases of 'Caddis-flies.'

V.—NOTES ON THE PHYSIOLOGY AND PATHOLOGY OF FISHES.

By George Sandeman, M.A., F.Z.S., of the Marine Laboratory, St Andrews.

It is impossible for me to give more than a bare outline of the results of my investigations into the internal organs of fishes, chiefly of salmon, which I have carried on during the past year, as they are at present necessarily incomplete, owing to the impossibility of obtaining hitherto material throughout the whole year. These researches, carried on chiefly at the St Andrews Marine Laboratory, and later at the Laboratory of the College of Surgeons, Edinburgh, and at the Laboratory of Comparative Pathology in Paris, may here be shortly referred to under two heads, namely, a study of the seasonal histological changes in various marine fishes and in the salmon, with a view to the elucidation of the physiology of these forms; and secondly, observations of peculiar diseased conditions in various fishes obtained from different sources, as well as those affected by an artificial change of their conditions. In addition to the following observations there are many normal and diseased conditions which have come under my notice, but which I understand so little that I do not feel justified in even referring to them as yet, even in a cursory note.

1. Seasonal Changes in the Histology of Fishes.

The material for this study consisted of the viscera of salmon, which were kindly supplied to me by Messrs Anderson & Sons of Edinburgh, and Mr Speedie of Perth, during the open season of 1893. The whole mass of viscera from each fish was sent intact, with a label attached, on which was written the weight of the fish, the date, and, in some cases, the river from which it came. These were forwarded to the St Andrews Laboratory in large jars containing a strong solution of common salt. The weight of each organ and the weight of the fish were immediately tabulated, and notes were taken of the microscopic appearance of the organs. The specific gravity of the liver, its reaction to iodine, and, especially, the amount of fat contained in it, were noted; and the spleen, which shows very various appearances, was in all cases carefully examined for the presence of waxy degeneration. The weights of the reproductive organs were, of course, the most important points in the research, but, as will be seen later, the necessary presence of certain fallacies made it impossible to connect any definite degree of maturity either with the time of year or with the locality. The stomach and intestinal canal were opened, and the food, in the rare cases in which any was present, was examined, and a note was kept of the numerous and various parasites which are found in the alimentary canal and even in the general body cavity of the Salmonidæ. Special attention was paid to the weight of the pyloric gland, with the rich store of fat associated with it, and, in some cases where portions of muscle were obtainable, their histological character was examined. Owing to the necessarily inexact weights which were given for the complete fish, as well as to the limitation of the research to the open season, and to the absence of any adequate literature on the subject to form a guide to my work, it has been impossible to find even an average proportional weight of the various organs to the body; the reproductive organs, the liver, and the pyloric gland being especially vari-

able in this respect. Only after the continued observation of the organs of the salmon throughout the seasons for two or three years, such as I hope may be made possible for me, will it be possible to find the laws which determine the extraordinary developments and atrophies of the various parts which take place in the annual migration into fresh water, and to find what of these changes result from the apparently complete fast of the salmon in the rivers, and what have for their cause the altered medium both chemically and as regards its specific gravity, and the altered conditions of temperature, and the increased muscular exertion of the journey, associated with the profound histological changes which frequently, at all events, take place in the muscles at that time. The researches of Miescher, though I am not able in all cases to substantiate his estimate of weights of the various organs, (though the difference in result may well be due to the difference of the conditions which obtain in the Rhine and in Scotland), are of great interest in this connection, and afford a basis for further research. He found that, during the migration from the mouth of the river to the spawning-beds, which covers, according to his estimate, from four to fourteen weeks, and during which he found the intestinal canal always completely empty, that the ovary grows entirely at the expense of the large lateral muscles of the trunk, which lose their proteids, their fat, and mineral salts, undergoing to a certain extent the vitreous degeneration found in man in certain febrile conditions. The ovary grows from 6·4 to 19·27 per. cent. of the weight of the fish, and increases largely in the possession of lecithin and nuclein.* I have found the ovary less in weight than the minimum given in Miescher's figures, but the extraordinarily rapid growth of the organ, as well as of the testes, which never reach such a size as the ovaries, is not over-stated at a fifth of the whole mass in the latter case, just before spawning, from being less than a twentieth. It is remarkable that two fishes marked as having the same weight and coming from the same source may differ in the weight of the reproductive gland as much as in the proportion of two to three. This variability takes place to such a high degree in the other organs also, that when a graph was made including 160 specimens, in which the weight of the fish was reduced to unity, no regular proportion could be found to exist among them ; all the viscera, the spleen least, and the mass of fat around the pyloric gland the most, being represented by no definite lines or curves, but by wholly irregular zigzag tracings. As to the cause of this variability, I can offer no suggestion beyond the extremely variable conditions of food supply in which fishes find themselves, together with that free independence as to size, weight, and physiological conditions which exists among the organs of almost all species of fishes which I have examined, and which is referable not only to their comparatively low organisation, but also, and in a higher degree, to the nature of their habitat, which renders unnecessary, and indeed makes impossible, those close alterations in the relative size and weights of parts which accompany the growth of land animals, and are due to the much more rapid increase in weight of the body than in strength of its supporting and locomotory structures.

In the stomachs of certain salmon I have found fragments of the vertebral column of fishes which I was unable to identify, and, in one or two cases taken from the sea, I have found the remains of sand-eels, and, in one case, of whiting; but later in the season, and in fish which had already travelled some distance up stream, I have found nothing in the

* Miescher, Separatabdruck aus der Schweizerischen Literatursammlung zur Internationalen Fischerei-Ausstellung in Berlin, 1880. *Statistische und biologische Beiträge zur Kenntniss vom Leben des Rheinlachses,* also a note in the *Archiv fur Anatomie und Physiologie,* 1881.

intestine but a mass, in some cases considerable, consisting of débris of epithelial cells, in some cases angular fragments of what might be chitin, the whole being often imbedded in a mass of glairy mucus. The form of the stomach itself is considerably altered; from being a large thin-walled organ it becomes contracted and thickened into a tube with hardly any lumen, the inner surface of which is puckered and thrown into deep rugæ. It has then about the thickness of a man's thumb. The mass of fat around the pylorus is appreciably diminished as the season progresses, but, in all the cases I have seen, it still remains considerable. The ramifications of the gland, always empty of food, contain, as do the stomach and the lower intestine, one or more, usually many, tape worms, which sometimes reach a great length. These are not in all cases restricted to the gut, but were in two cases which came under my notice, lying free in the body-cavity to which they had gained access in some manner unknown. Other parasites are small round worms, frequently present in large numbers in the alimentary canal, and sometimes ciliated infusorians which I did not identify. The liver diminishes to a certain extent in the amount of fat it contains, and consequently increases in specific gravity; but there is always a considerable infiltration of fat from which I have only seen one set of fishes, to be described later, entirely free. This fatty condition has often proceeded to such an extent as to make the whole organ of a light yellow colour to the eye, and to give a microscopic section of it, treated with osmic acid, a black appearance throughout. When a section is deprived of its fat, and stained by any of the ordinary methods, there may be often seen none of the essential elements of the organ which are not reduced by the excessive size of the fat droplets to mere hollow spheres, 'signet-rings' of extreme thinness, the nucleus of which seems to exist without almost any cytoplasm. Unfortunately, owing to the impossibility of obtaining fresh material, it was impossible to make that chemical examination of the liver which alone could give us an idea of the nature of its activity under these circumstances, but I am strongly of opinion that it is at these times entirely functionless; indeed, if the fish, as seems to be the case, takes no food, a doctrine with which it is after all difficult to make the success of angling agree, there would be no need for the action of the liver, unless it takes a part in the transformation of the phosphates and proteids contained in the muscles into the higher chemical constituents of the reproductive organs. Indeed this whole subject is at present in the dark. I have taken green cod in April, whose liver was so fatty that microscopic examination revealed not a single liver cell which one could imagine to be functional, unless all the changes with which it is concerned take place through the passage of all the substances through a fat stage, which does not agree at all with what we know of the hepatic function in the higher vertebrates; and yet this fish was feeding actively, its stomach being crammed with food. The spleen varies less than all the other organs in size; it has usually an extremely soft and diffluent appearance, is often much congested, and in a certain proportion of cases shows a certain amount, but never very great, of waxy change, recognised by the dark coloration it gives on addition of a weak solution of iodine in potassium iodide, and by the pink appearance of the changed parts in a section treated with methyl-aniline-violet in contrast to the strong blue colour of the normal tissue. This change takes place around the arterioles after the manner known as the 'sago' change. This pathological condition, which occurs to an extreme degree in the eels described later, is of extreme interest in fishes, from the point of view of comparative pathology; though the substance produced differs slightly from that occurring in human disease, in that the red reaction to

the aniline dye, mentioned above, is not fixed, but disappears with prolonged washing in water. I have been fortunate enough to produce artificially this change in the spleen of small fishes kept in captivity and subjected to an abnormally high temperature, together with other disadvantageous conditions. As to the change in muscle, which should be most carefully studied in relation to the alterations in the viscera, I am unable, owing to the unfortunate limitation of the material supplied, to give any complete account for the salmon. I may just refer to the occurrence of hyaline change, and also of a breaking down of the fibre, accompanied with the production of fat and pigment, and the invasion by leucocytes, but I am quite unable to say whether any or all of these changes occur so frequently as to deserve a place in an account of the normal seasonal change in the salmon. In conclusion I may mention that, owing to the kindness of Mr Archer, I hope during the current year to have a complete supply of specimens from fish that have been accurately weighed and tabulated, and that, in collaboration with Mr Grey, I may shortly be in a position to give a detailed account of the physiological history of the salmon during the course of the year.*

2. Pathology.

Various fishes were sent to me for examination by Mr Archer and Dr Fulton on account of obvious or obscure pathological conditions. Two specimens of trout, given me by the first-named gentleman as examples of a number of fish which had succumbed to some unknown epidemic in an Irish river, were in good condition, and the liver was plentifully supplied with fat. Though the animals were not well preserved it was possible to make out that there was no grave disorder in any of the viscera, nor were there more parasites than is usual; the muscles were quite healthy. Though it is impossible to give a definite opinion as to the cause of death, I am inclined to find it in the condition of the epithelium of the gills, which was considerably thickened; its cells being more numerous and loose than is normal. Everything points to a catarrh of the gills, brought on, I suppose, by some noxious substance in the water in which they lived, or by an infection of bacteria, though I was not able to make out any of the latter. You can cause such a catarrh, with fatal results, artificially.

Dr Fulton and Professor M'Intosh sent me various soles from the tanks in the Dunbar Hatchery, having extensive discoloration, sometimes attended with the formation of abcesses, chiefly on the ventral surface. As these differed in no important respect from a condition which I frequently remarked in the soles during their transport about the East Coast and up to Dunbar on board the 'Garland,' I will describe them altogether. As in the latter case there was an abundant supply of water, it was impossible to refer the condition to any organic or inorganic toxic influence of the medium, as indeed was evident from the definite superficial localisation of the lesions. These are usually, if not always, directly due and following in a very short space of time on mechanical blows or abrasions, to which flat-fishes are especially liable and sensitive, though the presence—in a Dunbar specimen—of large numbers of bacteria in the wide abcess may point, if not to bacteria as the cause, yet to the necessity of keeping the water, in which fish are kept in captivity, scrupulously clean. These discoloured patches on microscopical examination are seen to be due to extensive hæmorrhages and stasis of the blood in the vessels over the area affected, with all the accompanying signs of superficial inflammation, crowds of leucocytes being present and invading the superficial layers of

* *Vide* a paper, by Professor M'Intosh, 'On the Food and Parasites of the 'Salmon of the Tay.'—*Proc. Linn. Soc.*

muscle, which break up, with the production of fat droplets, even when the condition is only slight. As a result of the bleeding, you have in older cases a deposit of pigment irregularly through the area, but I have never had the opportunity of studying a fish in which the inflammation had been succeeded by any but the first attempts at repair, as these very delicate fish appear to succumb very rapidly to these lesions. On board the 'Garland' I always referred them to the scraping of the fish over the bottom and against the sides of the tanks, and in some cases they were so slight as to seem wholly inadequate to cause death, but it will be frequently noticed that a quite inconsiderable abrasion from the trawl or an accidental blow is fatal, sooner or later, so that Dr Fulton's method of transporting flat-fishes in tanks completely closed and full of water, minimising or entirely obviating any oscillation of the fishes with the movements of the vessel, seems to be the only safe means of transport. It seems not unlikely that the fish which died at Dunbar had been injured in this manner in transport.

I have studied very fully the phenomena of repair after wounds and abrasions in round fishes, an account of which must be given at some other opportunity. But in this connection it must be said that they will speedily recover from very grave injuries which lead in soles to death in a few hours.

A short preliminary note may be given here of some interesting eels which I found in the loch on the Isle of May, just to the south of the engine-house of the Scottish Lights Commissioners, and specimens of which have been sent to me from time to time. These fishes, which are supposed to be of a considerable age from the fact that the inaccessability from the sea makes a continuous supply of eels from a marine breeding ground impossible, as well as because all of them have reached a considerable size apparently with a very scanty supply of food, present certain very profound pathological changes. They are so emaciated that the skeleton protrudes in sharp points in the skull, and is visible as the vertebræ throughout the tail; the weight, also, of the muscles is reduced to one-half the normal and the liver to less than one-third the normal weight, as compared with eels taken from Loch Fitty at the same time and of the same size; and this extreme atrophy, caused as well by the probable great age of the organisms, as by their want of food, and it may be by the abnormal thermal conditions of the pond which is used as a condensing tank by the engines, is associated with a great want of activity and vigour, which may be perhaps also referred to the almost complete blindness of a considerable number of the specimens. For the eyes in some cases, exceeding the normal area many times, and being also considerably protruded, giving to the head a most unfamiliar appearance, have an opaque white look like ground glass in part or throughout. A section of the superficial epithelium shows it immensely hypertrophied in thickness, and crowded with Sporozoa of an unfamiliar species in that they produce regularly six spores instead of four or two. These organisms lying in great numbers between the cells, the relations of which are thereby much disturbed, and in some cases within them, are in the deeper layers smaller than more superficially, and are in the active condition. Towards the surface, however, they are in some cases rounded, with the formation of spores, but more often show an internal degeneration associated with the production of brown crystals and more frequently with a granular or fibrillar grey débris. This process continues until nothing is left of the organism but a huge vacuole between the cells, and towards the surface of the epithelium this condition reaches such an extent that no cellular elements can be seen but a few compressed between the large abundant vacuoles, and having their nuclei

ill-defined and reacting very slightly to the ordinary nuclear stains. At the surface of the eye this vacuolisation, which is by no means equally extensive in every part, or in all the specimens, leads to an irregular broken surface, and renders the epithelium comparatively opaque. The liver is the only liver, which, according to the standards of human histology, can be called normal, among all the fishes I have examined, except that, though there is none of the usual fatty infiltration, there are local deposits of pigment in the lobules, though it is more diffuse than that like it which will be mentioned as occurring in the spleen, and in parts occurs as small granules abundantly scattered among the cells. The capsule of the liver is thickened and very fibrous, and there is a good deal of hypertrophy of the connective-tissue throughout the organ in some specimens. The whole organ appears rather hard, and is dark brown in colour, and firm on section.

The spleen has undergone the change described above as at least closely comparable to the familiar waxy degeneration, and that both in respect of the Malpighian bodies and the connective tissue of the spleen pulp, so being both 'sago' and 'diffuse', a condition very rare in man, and of which I have only seen one specimen. On section the clear homogeneous bacony substance is spread over large areas, broken only by small passages here and there containing blood corpuscles, and marking the lumen of a vessel not yet entirely occluded, or by masses of the elements essential to the organ. Here also the stain with methyl-aniline-violet is only a fugitive one, though the rose coloration is at first very brilliant, but the stain with iodine is normal to the condition, being by reflected light mahogany brown, and by transmitted light a clear homogeneous yellow. Throughout the spleen there are patches of pigment which show up very vividly in an unstained section, but there is no diffuse pigment; it occurs in dark brown irregular granules closely heaped together, and is very regularly distributed throughout the organ. The capsule of the spleen is very much thickened, and shows especially on its inner layers the same pink reaction with the aniline dye, though not so brilliantly and more fugitively than is the case with the essential structure of the spleen. The organ is small and very firm to the knife, containing, of course, only a very small quantity of blood. The degeneration has not occurred to the same extent in all the specimens, and some are free from it.

The ovaries presented a considerable change. The ova were thickly beset with fat droplets, the connective tissue was much thicker than in the normal specimens I used for comparison, and the whole organ had diminished in size. The skin was hard, rough, and leathery, and the scales all over its surface were very evident. It also contained, but not to such an extent as the conjunctiva, psorosperms in various stages, but without the vacuolisation described above. It is interesting that one of my control eels was infected with these organisms by being kept in the same tank with one of these fishes. The muscles of these eels were considerably broken down in various places, though in others quite normal. In affected portions there was pigment and hyaline degeneration, as well as a splitting of the element and invasion by white blood corpuscles. The blood seemed to be normal except that there were perhaps more non-nucleated elements than is usual, but that might quite well be due to their life in captivity prior to examination. Mr Holt has told me of a conger eel, the eyes of which apparently resembled those which I have found to be affected with Gregarines, but I have not found them on the eyes of any other fish. In my essay on these forms, presented by M. de Varigny to the Societé de Biologie of Paris, I have referred to the significance of the above changes in the comparative study of senility in land and aquatic animals.

During the past year I have also studied the maturation of the ova in the eel, but, as I have not been able to secure a complete series of specimens, I must defer any account of the process. I hope to givea full account of these researches as well as of my work on the blood of fishes shortly.

In conclusion, I have to express my warmest thanks to Dr Fulton, to Dr Noel Paton of the Royal College of Surgeons Laboratory, Edinburgh, to M. de Varigny of the Laboratoire de Pathologie Comparee of Paris, and, especially, to Professor M'Intosh of St Andrews Marine Laboratory, for their help and encouragement in my work. Thanks are also due to W. Archer, Esq., for material and advice, as well as to Dr H. Reynolds Brown for much assistance in the study of the blood. Also to the captain and crew of the 'Garland', who took the greatest trouble to help me in every way.

VI.—LIST OF SOME OF THE PELAGIC OVA, LARVÆ, AND YOUNG FISHES OBTAINED BY THE s.s. 'GARLAND' AND BOAT 'DALHOUSIE' IN 1894.

By H. C. Williamson, M.A., B.Sc., St Andrews Marine Laboratory.

From Tow-Nets of the 'Garland.'

St Andrews Bay.—14th February 1894. 3 eggs of plaice; 12 eggs of haddock; 2 eggs of whiting (?).

Firth of Forth—Station VIII.—21st February 1894. 16 eggs of plaice; 30 eggs of haddock; 16 eggs of green cod; 5 eggs of *Motella*.

— Station IX.—21st February 1894. 3 eggs of plaice (advanced); 3 eggs of green cod (advanced); 1 egg of haddock; 1 egg of *Motella*.

— Station V.—22nd February 1894. 1 egg of plaice; 2 eggs of green cod; 1 egg of whiting; 1 egg of *Motella*.

— Station VI.—26th February 1894. 1 egg of green cod; 2 eggs of whiting.

— Station VI.—6th March 1894. 4 eggs of plaice (ready to hatch).

— Station VI.—6th March 1894. Post-larval *Cottus*, 9 mm.; Montagu's sucker, 4·5 mm.; sand-eel, 4 mm.

— Largo Bay.—16th March 1894. 35 eggs of long rough dab; 9 eggs of plaice; 1 egg of haddock; 30 eggs of flounder; 130 eggs of dab; 1 egg of solenette; 216 eggs of *Motella*.

— Largo Bay.—16th March 1894. *Cottus*, 6·5 mm.

— Station V.—29th March 1894. An aggregate of about 2000 eggs of long rough dab; 199 eggs of haddock; 9 eggs of whiting; 3 eggs of cod; 25 eggs of flounder; 6 eggs of dab; 192 eggs of *Motella*. The eggs varied in development from ½ round to ready to hatch.

— Station VI.—29th March 1894. An aggregate of about 1400 eggs of long rough dab; 12 eggs of plaice; about 500 eggs of haddock; 50 eggs of flounder; 77 eggs of dab; 594 eggs of *Motella*. The eggs of each species varied in development from ½ round to ready to hatch.

St Andrews Bay.—6th April 1894. Four Series (no Station given).

— Series I.—31 eggs of long rough dab; 3 eggs of plaice; 98 eggs of haddock; 7 eggs of whiting; 1 egg of flounder; 129 eggs of dab; 31 eggs of *Motella*. Eggs well advanced, ready to hatch.

— Series II.—3 eggs of long rough dab; 26 eggs of haddock; 1 egg of whiting; 9 eggs of flounder; 5 eggs of dab; 1 egg of *Motella*. Eggs ready to hatch. 13 gadoids, 5·75 to 9·5 mm.; 6 sand-eels, mm.

— Series III.—21 eggs of long rough dab; 25 eggs of haddock; 9 eggs of whiting; 41 eggs of dab; 4 eggs of *Motella*. Eggs well advanced.

— Series IV.—290 eggs of long rough dab; 4 eggs of plaice; 66 eggs of haddock; 14 eggs of whiting; 18 eggs of cod; 50 eggs of flounder; 1 egg of dab; 73 eggs of *Motella*. Eggs well advanced; in one or two embryo only ½ round. 3 gadoids, 8·5 to 9 mm.

Firth of Forth—Station I.—Surface, 16th April 1894. 6 eggs of plaice; 32 eggs of haddock; 15 eggs of whiting; 12 eggs of cod; 3 eggs of flounder; 33 eggs of dab; 80 eggs of *Motella*.

— Station III.—Surface, 16th April 1894. 1 egg of long rough dab; 3 eggs of haddock; 3 eggs of whiting; 4 eggs of cod; 2 eggs of flounder; 1 egg of dab.

— Stations VIII. and IX., East of May, 17th April 1894.—50 eggs of long rough dab; 20 eggs of plaice; 18 eggs of gurnard; an aggregate of about 5000 eggs of haddock; about 1890 eggs of whiting;

about 940 eggs of cod; 120 eggs of flounder; 270 eggs of dab; about 1570 eggs of *Motella.*

Firth of Forth—Station IX.—Bottom, 17th April 1894. 5 eggs of plaice; 4 eggs of haddock; 1 egg of whiting; 2 eggs of cod; 5 eggs of *Motella.*

— Station V., West of May, 17th April 1894.—Surface. 22 eggs of long rough dab; 1 egg of gurnard, 130 eggs of haddock; 14 eggs of whiting; 101 eggs of cod; 1 egg of flounder; 6 eggs of dab; 96 eggs of *Motella.*

— Station V.—Bottom, 17th April 1894. Some eggs of haddock, whiting, flounder, dab, and *Motella;* 5 gadoids, 13 mm.; 2 sand-eels, 10 and 11 mm.

— Station VI.—Surface, 18th April 1894. 50 eggs of long rough dab; 4 eggs of gurnard (early); 162 eggs of haddock (early to advanced); 43 eggs of whiting; 13 eggs of cod (advanced); 7 eggs of flounder (early); 10 eggs of dab (early); 1 egg of solenette (early); 129 eggs of *Motella* (early to advanced); sand-eel, 8 mm.

— Station VI.—Bottom, 18th April 1894. 1 egg of plaice; 17 eggs of haddock; 2 eggs of whiting; 1 egg of flounder; 1 egg of dab; 2 eggs of *Motella.*

— Station VI.—Bottom, 18th April 1894. Larvæ; 18 clupeoids, probably sprats, 9 to 10 mm.

From Tow-nets of the 'Dalhousie,' in St Andrews Bay.

Surface and Bottom.—14th March 1894. 1 egg of long rough dab (embryo ½ round); 2 eggs of plaice; 1 egg of haddock; 39 eggs of flounder; 27 eggs of dab; 68 eggs of *Motella* (early to ½ round).

Surface and Bottom.—15th March 1894. 1 egg of long rough dab; 1 egg of haddock; 15 eggs of dab (early); 19 eggs of *Motella.*

Bottom.—15th March 1894. Larvæ; gadoid, 9·25 mm.; 4 sand-eels, 4 to 5 mm.

Surface and Bottom.—16th March 1894. 1 egg of long rough dab; 6 eggs of dab; 52 eggs of *Motella.*

Surface and Bottom.—16th March 1894. Larvæ: 2 *Cotti,* 6 and 6·25 mm.; 2 Montagu's suckers, 3·25 and 3·5 mm.; 34 sand-eels, 4 to 9 mm.

Surface.—21st March 1894. 1 egg of plaice; several eggs of dab; a number of eggs of *Motella.*

Surface.—22nd March 1894. Fair number of eggs of flounder, dab, and *Motella.*

Surface.—27th March 1894. Several eggs of long rough dab; large number of eggs of *Motella.*

Surface.—29th March 1894. A few eggs of long rough dab, a few eggs of flounder and dab; large number of eggs of *Motella.*

Surface.—30th March 1894. 1 egg of green cod; a few eggs of flounder and dab; many eggs of *Motella.*

— 27th, 29th, and 30th March 1894. Larval and post-larval sand eels, largest 5·75 mm.

Surface.—31st March 1894. 15 eggs of long rough dab; 37 eggs of flounder; 36 eggs of dab; 127 eggs of *Motella.* The eggs of each species were well advanced.

Off Tent's Muir.—Surface, 2nd April 1894. 4 eggs of long rough dab; 1 dead egg (cod?); 7 eggs of flounder; 5 eggs of dab; 15 eggs of *Motella.*

Surface.—5th April 1894. 4 eggs of long rough dab; 18 eggs of haddock; 10 eggs of whiting; 6 eggs of flounder; 36 eggs of dab; 36 eggs of *Motella.*

Off Kinkell Ness.—Surface, 9th April 1894. 5 eggs of long rough dab; 24 eggs of haddock; 1 egg of whiting; 1 egg of cod; 9 eggs of flounder; 2 eggs of dab; 160 eggs of *Motella*. Eggs of each species well advanced; eggs of *Motella* from ½ to ⅔ round.

Off West Sands.—Bottom, 10th April 1894. 4 eggs of haddock; 1 egg of whiting; 2 eggs of flounder; 3 eggs of dab; 2 eggs of *Motella*.

Off West Sands.—Bottom, 10th April 1894. Pleuronectid larva, 6·3 mm.; post-larval long rough dab, 5 mm.; *Cottus*, 6 mm.; 70 sand-eels, 5 to 14 mm.

Off Kinkell Ness.—Surface, 12th April 1894. 1 egg of long rough dab (embryo ½ round); 5 eggs of haddock (ready to hatch); 1 egg of cod (early); 1 egg of poor-cod (early); 2 eggs of flounder (early); 55 eggs of dab (from early to ⅔ round); 125 eggs of *Motella* (advanced).

Off Kinkell Ness.—Surface, 12th April 1894. 3 sand-eels, 7·5 to 9 mm.; *Cottus*, 5 mm.

Surface.—16th April 1894. 1 egg of long rough dab; 8 eggs of haddock; 2 eggs of pollack; 44 eggs of whiting; 4 eggs of cod; 8 eggs of flounder; 131 eggs of dab; 313 eggs of *Motella*. Eggs of each species are early; a few, however, ready to hatch.

Midwater-net.—16th April 1894. 1 egg of long rough dab; 4 eggs of haddock; 11 eggs of whiting; 2 eggs of cod; 31 eggs of dab; 174 eggs of *Motella*. The eggs are early; a few of each species, however, are ready to hatch.

Surface.—17th April 1894. 3 eggs of long rough dab; 2 eggs of haddock; 1 egg of bib; 6 eggs of whiting; 6 eggs of cod; 2 eggs of flounder; 11 eggs of dab; 43 eggs of *Motella*. Most of eggs are early; some advanced.

Surface.—20th April 1894. 1 egg of pollack; 3 eggs of whiting; 3 eggs of cod; 3 eggs of turbot; 4 eggs of dab; 38 eggs of *Motella*.

List of some of the Pelagic Ova, Larvæ, and Young Fishes obtained off the East Coast in May, &c., 1894. By James R. Tosh, M.A., B.Sc., St Andrews Marine Laboratory.

9th May.—10 miles off Stonehaven. 1 egg of plaice; 4 eggs of haddock; 3 eggs of whiting; 6 eggs of gurnard; 2 eggs of green cod; 4 eggs of rockling; 7 eggs of cod; 2 eggs of long rough dab; 2 eggs of brill; 1 egg of poor-cod; 1 poor-cod larva.

9th May.—12 miles off Stonehaven. 9 eggs of haddock; 4 eggs of whiting; 12 eggs of gurnard; 3 eggs of rockling; 10 eggs of cod; 2 eggs of long rough dab; 2 eggs of brill; 18 larval cod.

12th May.—7 miles off Aberdeen. 19 eggs of haddock; 68 eggs of gurnard; 41 eggs of cod; 2 eggs of green cod; 5 eggs of long rough dab; 1 egg of poor-cod; 3 eggs of rockling; 3 eggs of bib.

13th May.—Mouth of Moray Firth. 149 eggs of gurnard; 7 eggs of bib; 20 eggs of rockling; 22 eggs of haddock; 19 eggs of cod; 4 eggs of whiting; 3 eggs of green cod; 1 egg of plaice; 1 small egg of dab; 9 eggs of brill; 3 eggs of three-bearded rockling.

16th May.—15 miles off Montrose. 2 eggs of cod; 47 eggs of gurnard; 2 eggs of haddock; 1 egg of plaice; unknown eggs, 6. [1·3335 mm.]

24th May.—46 eggs of gurnard; 6 eggs of brill; 1 egg of plaice.

7th May.—1 gunnel, 22 mms.; 1 gadoid, 12 mms.; 38 sand-eels, 15 to 27 mms.

9th May.—6 suckers, 7·5 to 13 mms.; 1 cat-fish, 19 mms.; 18 sand-eels, 15 to 25·5 mms.; 23 gadoids, 7·5 to 20 mms.; 1 pogge, 10 mms.

10th May.—13 sand-eels, 12·5 to 30 mms.

11th May.—2 cat-fish, 19 to 22 mms.; 3 gadoids, 10 to 23 mms.; 2 flat-fish, 11·5 to 13 mms.; 3 pogges, 13 to 15 mms.; 1 sand-eel, 14·5 mms.

16th May.—Off Aberdeen. About 16,000 sand-eels and flat-fish.

19th May.—Off Montrose. 6000 sand-eels and flat-fish.

21st May.—Off Stonehaven. About 20,000 sand-eels, flat-fish, gunnels, &c.

St Andrews Bay.—28th April 1894—Surface tow-net. 28 eggs of 5-bearded rockling; 1 egg of grey-gurnard; 13 eggs of dab; 8 eggs of green cod; 3 eggs of haddock; 5 eggs of whiting.

— 22nd May 1894. 3 eggs of whiting; 3 eggs of gurnard; 1 small egg like that of dab.

— 23rd May 1894. 4 eggs of rockling (embryo half round); 1 egg of dab.

— 9th June 1894. 17 eggs of 5-bearded rockling; 5 eggs of dab; 2 eggs of sprat.

— 11th June 1894. 1 egg of rockling; 1 egg of dab; 1 young goby, 8·5 mms.

— 12th June 1894. 10 eggs of pleuronectid (?) [8·5, Jackson]; 3 eggs of sprat; 3 eggs of 5-bearded rockling; 1 young goby, 9 mms.

Tow-Net Collections on Board H.M.S. 'Jackal.'

Station IV., 9 to 10 a.m., 1st May 1894. 55 eggs of 5-bearded rockling; 2 eggs of 3-bearded rockling.

New Station XXIII., 8.40 to 9.20 p.m., 3rd May 1894. 3 eggs of plaice; 5 eggs of haddock; 18 eggs of cod; 25 eggs of gurnard; 7 sand-eels, 23 to 27 mms.; *Parathemisto oblivia.*

Lerwick Harbour, 1 to 4 p.m., 3rd May 1894. No ova. Cypris stage of Cirripedes. Numerous small Medusæ, *e.g.*, *Phialidium*, young *Bougainvilleæ*, *Sarsia gemmifera*, and *Lizzia.*

VII.—THE CAPTURE AND DESTRUCTION OF IMMATURE SEA FISH. PART III. THE RELATION BETWEEN THE SIZE OF THE MESH OF TRAWL-NETS AND THE FISH CAPTURED.

By Dr T. Wemyss Fulton, F.R.S.E., Superintendent of Scientific Investigations.

In previous Reports the determination of the size of immature fish of various species, their distribution at various depths around the coast, their degree of vitality when captured, and various other points connected with the immature fish question have been dealt with (*Eighth Annual Report*, Part III., p. 157, 1889; *Ninth Annual Report*, Part III., p. 201, 1890). Since these papers were published a considerable amount of similar work has been accomplished elsewhere, especially by Mr E. W. L. Holt, and Mr J. T. Cunningham of the Marine Biological Association, and by Dr Petersen of the Danish Fisheries Department. Last year also an important Committee of Parliament was appointed, on the motion of the President of the Board of Trade, to enquire into this among other questions connected with sea fisheries, and has recommended that the landing and sale of soles and plaice under eight inches, and of turbot and brill under ten inches, in extreme length, should be prohibited,* the assumption being that such a measure would cause vessels, accustomed to trawl on certain grounds where small fish of these kinds abound, to abstain from doing so. The question of the size of mesh of trawl-nets was raised, and the evidence given on this point was somewhat conflicting; the general opinion among the practical men being that the size of the mesh of the net had little or no influence on the size of the fish captured, owing to the meshes being drawn together by the strain on the net while fishing. No recommendation touching this part of the subject was made by the Committee.

The experiments described in the following pages were carried on for the purpose of ascertaining, as precisely as possible, the relation between the fish caught—and especially their sizes—and the size of the meshes of trawl-nets used in their capture. The experiments were made on board the 'Garland,' partly in the Moray Firth, and chiefly in the Firth of Forth, St Andrews Bay, or the neighbourhood. The records were nearly all kept by Mr Scott, in some cases by Captain Campbell, the fish being measured and counted by Mr Liston, the mate. The beam used was the ordinary one of 25 feet, which has been employed by the 'Garland' in the trawling work for years. The main portions of the net were also similar, but the terminal part, or cod-end, was varied; and outside the trawl-net, enveloping the cod-end, was fixed a small-meshed net, the meshes of which measured half-an-inch from knot to knot. The purpose of this was to retain the fishes which passed through the meshes of the cod-end. The cod-ends alternately used were five in number:—(1) The ordinary one with meshes of double twine, and one-and-a-half inches from knot to knot; (2) one with meshes of single twine measuring one-and-a-half-inches from knot to knot; (3) one with two-inch meshes; (4) one with two-and-a-half-inch meshes; and (5) one with three-inch meshes. The experiments were all carried on during daylight, the vessel steaming at a speed of about four knots while the trawl was down, and the duration of each haul lasted from about one-and-a-half hours to over three hours.

* *Report from the Select Committee on Sea Fisheries*, p. iv., 1893.

The total number of hauls made was 67, and the fish captured numbered 57,714, of which 18,312, or over 31 per cent., were found in the trawl-net; and 39,402, or about 69 per cent., in the outer small-meshed net, having passed through the meshes of the trawl. Of the total number of fishes caught, 118 were skates and rays, 24,092 were flat-fishes, 31,667 were 'round'-fishes (cod, haddocks, whitings, &c.), and 1837 belonged to other species (herrings, anglers, &c.) as mentioned later. The experiments were therefore on a considerable scale.

1. Experiments with the Ordinary Trawl-Net, having Meshes in the Cod-end 1½ Inches from Knot to Knot.

The greater number of the experiments were made by the ordinary net in daily use, the meshes of which, in the cod-end, are 1½ inches from knot to knot. Outside this net the small-meshed net was fixed as above described. The number of hauls made was 43, and the total number of fish caught was 42,722. Of these 14,381, or about 33 per cent., were found in the trawl-net, and no less than 28,361, or about 66·3 per cent., in the outer net, having passed through the meshes of the trawl. The total number of flat-fish taken was 19,808, of which 7236 were found in the trawl-net, and 12,786 in the outer net. The number of round-fish (cod, haddocks, whitings, gurnards, ling and saithe) was 22,015, of which 7236 were in the trawl-net, and 14,779 in the outer net. The figures are as follow:—

	In Trawl-Net.	In Outer Net.
Grey skates,	13	...
Thornback rays,	30	...
Starry ,,	9	...
Sandy ,,	2	...
	54	
Plaice,	2705	67
Lemon soles,	371	154
Witch ,,	38	1
Common dabs,	3367	9892
Long rough dabs,	506	2562
Flounders,	20	...
Turbot,	1	...
Brill,	5	...
Soles,	3	...
Sailfluke,	3	...
Solenette,	3	110
	7,022	12,786

	In Trawl-Net.	In Outer Net.
Cod,	367	693
Haddocks,	5769	5226
Whitings,	450	8006
Brassie,	8	129
Ling,	4	2
Gurnard,	647	854
Herrings,	3	364
Sprats,	1	104
Father-lasher,	2	153
Three bearded rockling,	...	2
Four-bearded ,,	...	1
Anglers,	35	...
Saithe,	...	4
Pogge,	3	...
Catfish,	2	...
Dragonet,	8	1
Hake,	2	8
Gadus minutus,	1	16
Dogfish,	...	1
Goby,	...	1
Common pipefish,	...	1
Lumpenus lampetriformis,	...	4
	7,305	15,575

It will be observed that, while the majority of the flat-fishes were found in the outer net, they consisted for the most part of common dabs and long rough dabs. Thus of 13,259 common dabs captured, 9,892, or 74 per cent., passed through the meshes of the trawl-net; of 3,068 long rough dabs, only 506 were retained in the trawl, 2,562, or 83 per cent., passing through. It was very different with plaice, only 67, or 2·4 per cent., out of 2772 captured, escaping from the trawl. Since the mesh used in these experiments corresponds to the mesh of the cod-end employed by

ordinary trawlers, it is clear that the great majority of the dabs on grounds swept by the trawl escape through the meshes, while most of the plaice are retained.

The figures referring to the round fishes show that the majority of the cod ('codlings') manage to escape, that rather more haddocks are retained than pass through, and that most of the whitings also make their way out. The figures, in regard to herrings and sprats, are also of interest from another point of view.

2. Experiments with a Special Cod-end, having Meshes (of Single Twine) 1½ Inches from Knot to Knot.

Six experimental hauls were made with a cod-end, having meshes of one inch and a half from knot to knot, but made of single twine instead of double twine, like the ordinary cod-end. They were all made at the mouth of the Firth of Forth in June, in depths varying from 11 to 31 fathoms; the duration of each haul being two hours and a half. The total number of fishes taken was 5300, of which 2770, or 52·3 per cent., were found in the trawl-net, and 2530, or 47·7 per cent., in the outer net, having passed through the meshes of the former. The flat-fishes numbered 2226, of which 720, or 32·3 per cent., were in the trawl, and 1506, or 67·6 per cent., were in the outer net. The round fishes (cod, haddocks, whitings, and gurnard) numbered 3021; 2040, or 67·6 per cent., being in the trawl, and 981, or 32·5 per cent., in the small-meshed net. Three skates were in the trawl-net and seven other fish; the other fish (chiefly dragonet) in the outer net numbering 43.

	In Trawl-Net.	In Outer Net.		In Trawl-Net.	In Outer Net.
Plaice,	203	...	Thornback skates,	2	...
Lemon soles,	111	15	Starry ray,	1	...
Common dabs,	229	646		3	
Witch soles,	22	...			
Flounders,	2	...	Brassie,	1	...
Long rough dabs,	153	845	Angler,	1	...
	720	1506	Lumpsucker,	1	...
Cod,	67	27	Catfish,	4	...
Haddocks,	1748	155	Dragonet,	...	29
Whitings,	32	671	Pogge,	...	6
Gurnards,	193	128	Hake	...	1
	2040	981	*Lumpenus*,	...	7
				7	43

3. Experiments with a Cod-end having Meshes of 2 Inches from Knot to Knot.

These experiments were conducted in the same manner as the previous ones. Six hauls were made with this net, and the total number of fishes captured was 2972, of which 842 were flat fishes, 6 skates and rays, 1604 'round' fishes, and 520 other fishes. The number found in the trawl-net was 546, and the number in the outer small-meshed net was 2426. Thus of the fishes which entered the trawl-net only about 18·3 per cent. were retained, while about 81·6 per cent. passed through, and were caught in the smaller-meshed net. Of those found in the trawl-net, 6 were skates and rays, 281 were flat-fishes, 227 round fishes, and 30 other fishes; of those which passed through

the trawl-net and were retained in the outer net, 562 were flat-fishes, 1377 were round fishes, and 487 'other' fishes. The numbers of the various kinds are as follow :—

	In Trawl-Net.	In Outer Net.		In Trawl-Net.	In Outer Net.
Grey skates,	3	...	Cod,	95	176
Thornback rays,	2	...	Haddocks,	59	87
Starry rays,	1	...	Whitings,	73	1113
	6		Gurnard,	...	1
Plaice,	172	3		227	1377
Lemon soles,	15	4	Herrings,	23	485
Common dabs,	49	167	Sprats,	6	...
Flounders,	25	...	Anglers,	2	...
Long rough dabs,	13	387	Catfish,	1	...
Brill,	6	...	Dragonet,	...	1
Sail-fluke,	1	...	Pogge,	...	1
Zeugopterus,	...	1		32	487
	281	562			

It is observable that in those experiments much the same thing happened as in those with the 1½-inch mesh. The great majority of the plaice were retained in the trawl-net, and the greater number of the common dabs, and especially of the long rough dabs, passed through the meshes of the net. Most of the whitings also escaped, and, in this case, the greater number of the haddocks also.

4. Experiments with a Cod-end having Meshes of 2½ Inches from Knot to Knot.

With the cod-end having two-and-a-half inch-meshes six hauls were also made, and the number of fishes captured was 2278, of which 338, or 14·8 per cent., were found in the trawl-net, and 1940, or 85·1 per cent., which had passed through the meshes of the trawl, were found in the net outside. The number of skates and rays was 5, the flat-fishes numbered 943, of which 184 were in the trawl-net, and 759 in the outer net, the number of round fishes was 1289, of which 140 were in the trawl-net and 1149 in the outer net; and the number of other species was 42, 9 being in the trawl, and 33 having passed through it. The detailed figures are as follow :—

	In Trawl-Net.	In Outer Net.		In Trawl-Net.	In Outer Net.
Grey skate,	1	...	Cod,	5	7
Starry rays,	4	...	Haddocks,	58	464
	5		Whitings,	63	564
Plaice,	82	4	Gurnards,	14	114
Lemon soles,	27	28		140	1149
Witch soles,	14	...	Brassie,	1	1
Common dabs,	16	402	Catfish,	6	...
Long rough dabs,	40	325	Anglers,	2	...
Flounders,	3	...	Dragonet,	...	9
Turbot,	2	...	Saithe,	...	1
	184	759	Pogge,	...	11
			Herring,	...	2
			Lumpenus,	...	9
				9	33

5. Experiments with a Cod-end having Meshes of 3 Inches from Knot to Knot.

In the six hauls with this net, the total number of fishes captured was 4421. The trawl contained 277, or 6·2 per cent., and the outer net 4144, or 93·7 per cent.; thus by far the greater proportion passed through the meshes of the trawl. The number of flat-fishes in the trawl-net was 35, of round fishes 188, of skates and rays 44, and of other kinds 10; while, in the outer net, were found 6 skates and rays, 237 flat-fishes, 3550 round fishes, and 351 of other species. The figures are as follow:—

	In Trawl-Net.	In Outer Net.
Grey skates,	2	...
Thornback rays,	5	2
Starry rays,	37	4
	44	6
Plaice,	12	1
Lemon soles,	6	17
Common dabs,	4	58
Witch soles,	2	...
Long rough dabs,	10	161
Brill,	1	...
	35	237
Cod,	36	188
Haddocks,	28	536
Whitings,	124	2824
Gurnards,	...	2
	188	3550

	In Trawl-Net.	In Outer Net.
Herrings,	6	194
Sprats,	...	124
Anglers,	1	...
Catfish,	1	...
Pogge,	1	12
Dragonet,	1	11
Father-lasher,	...	7
Goby,	...	1
Lumpsucker,	...	1
Gadus minutus,	...	1
	10	351

6. Relation of the Size of Mesh to the Size of the Fishes Captured.

It will be convenient to consider together the results of the various experiments in regard to this subject. It may be noted, in the first place, as above indicated, how the proportion of the fishes found in the trawl-net diminishes, and the proportion retained in the outer net increases, as the mesh of the cod-end is enlarged; the percentage in the latter rising from 66·3 with the 1½-inch mesh to 93·7 with the 3-inch mesh. Further, it will be seen, regarding the totals only, irrespective of the species, that as the mesh is increased the proportion of round fishes which escapes increases to a greater extent than the proportion of flat-fishes.

Plaice (*Pleuronectes platessa*).

The number of plaice found in the trawl-net and in the outer net in the series of experiments with cod-ends of different meshes was 3348.

They may be classified according to their extreme length in inches as follows:—

	Size in Inches.															Total.
In Trawl-Net.	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Above 17	
1½-inch mesh .	..	79	452	491	330	309	227	172	163	161	58	119	41	18	85	2705
1½* „ „ .	..	..	..	..	..	18	16	22	36	32	37	24	8	7	3	203
2 „ „ .	..	..	..	4	4	3	8	9	38	53	2	17	28	..	6	172
2½ „ „ .	..	..	..	..	..	10	25	1	5	30	3	5	..	..	3	82
3 „ „ .	..	..	..	..	..	..	..	..	2	3	2	1	..	1	3	12
	..	79	452	495	334	340	276	204	244	279	102	166	77	26	100	3274
In Outer Net.																
1½-inch mesh .	4	20	17	17	8	..	..	..	..	..	..	..	..	..	..	66
1½* „ „ .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2 „ „ .	..	..	2	1	..	..	..	..	..	..	..	..	..	..	..	3
2½ „ „ .	..	..	..	2	1	1	..	..	..	..	..	..	..	..	..	4
3 „ „ .	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1
	4	20	19	20	9	1	..	1	..	..	..	..	..	..	..	74

It will be seen that, of the total number of 3348 plaice caught in all the experiments, only 74, or a little over 2 per cent., escaped through the meshes of the trawl-net, and were found in the outer net. In the experiments with the 3-inch mesh the number caught is insufficient to have any conclusions upon them. But the numbers caught with the ordinary 1½-inch mesh was large, and it will be seen that about 98 per cent. were retained in the trawl-net. The broad result of the experiments, in regard to this important flat-fish, is that no regulation of the mesh that would be practicable for fishing purposes would save anything like a considerable proportion of the under-sized and immature specimens, that entered the net, from capture. It has been shown elsewhere * that the distribution of very small immature plaice is peculiar and special, and that they are confined to the tracts near the shore, passing out into deeper water as they grow larger. Beyond the territorial waters, from which beam-trawling is excluded, comparatively few under 6 inches or so are to be found; and the size at which maturity is reached on the East Coast of Scotland is about 12 or 13 inches.

Lemon Soles (*Pleuronectes microcephalus*).

The total number of lemon soles taken in the course of the experiments was 747, of which 529 were caught in the trawl, and 218 in the outer net. Thus, the percentage of those which passed through the meshes of the trawl was about 29—a much larger proportion than with the plaice. The details of each series of experiments are as follow:—

* *Eighth Annual Report*, Part III., p. 168.

In Trawl Net.	Size in Inches.													Total.
	4	5	6	7	8	9	10	11	12	13	14	15	Above 15	
1½ in. mesh	...	1	16	50	25	72	39	66	20	37	17	8	20	371
1½* ,,	...	...	12	15	13	16	5	7	11	27	4	...	1	111
2 ,,	...	...	...	...	...	1	...	4	3	5	2	...	...	15
2½ ,,	...	...	...	2	1	...	4	2	4	12	2	...	...	27
3 ,,	...	...	...	...	...	...	...	...	3	...	1	1	1	6
In Outer Net.	...	1	28	67	39	89	48	79	41	81	26	9	22	529
1½-in. mesh	27	57	50	20	...	...	...	...	...	...	...	...	...	154
1½* ,,	...	6	9	...	...	...	...	...	...	...	...	...	...	15
2 ,,	...	2	1	1	...	...	...	...	...	...	...	...	...	4
2½ ,,	...	6	5	3	3	6	3	2	...	...	...	...	...	28
3 ,,	5	5	...	3	...	...	...	4	...	...	...	...	...	17
	32	76	65	27	3	6	3	6	...	...	...	...	...	218

Common Dab (*Pleuronectes limanda*).

The number of common dabs captured was large, namely, 14,830. Of these 3665 were caught in the trawl-net, and 11,165 in the outer net. These figures refer to the totals, and comprise the five series of experiments; and they show that only about 24·7 of those which entered the trawl were retained in it, the remainder passing on. The details are given in the table appended:—

In Trawl-Net.	Size in Inches.											Above 12	Total.
	2	3	4	5	6	7	8	9	10	11	12		
1½-inch mesh	...	9	103	758	1428	538	392	79	43	12	2	3	3367
1½* ,,	1	4	...	...	89	55	45	28	7	...	...	...	229
2 ,,	...	...	2	1	1	5	18	10	11	...	1	...	49
2½ ,,	...	1	2	2	1	...	4	...	5	1	...	...	16
3 ,,	...	...	1	...	...	...	...	...	1	1	1	...	4
In Outer Net.	1	14	108	761	1519	598	459	117	67	14	4	3	3665
1½-inch mesh	70	376	1934	5426	1667	410	9	...	...	...	...	...	9892
1½* ,,	170	109	163	139	65	...	...	...	...	...	...	...	646
2 ,,	1	1	33	36	48	34	14	...	...	...	...	...	167
2½ ,,	17	13	51	16	208	65	21	...	11	...	...	...	402
3 ,,	11	1	13	18	5	1	5	2	1	...	1	...	58
	269	500	2194	5635	1993	510	49	2	12	...	1	...	11,165

The effect of the gradual increase in the size of the mesh, upon the proportion of fish which escape from the trawl, is well brought out in this table. In the ordinary net used in trawling operations, with a mesh of one-and-a-half-inches, the great majority of the specimens at or below 6 inches in length escape; and, in the experiments with the larger mesh,

comparatively few are retained. It is obvious that, in ordinary trawling operations for commercial purposes, an exceedingly large proportion of these practically worthless fishes pass through the trawl-net and thereby escape capture, strongly contrasting therefore with what happens in the case of the plaice. The common dab attains maturity while still of small size,—about 5 or 6 inches in length.

The Long Rough Dab (*Hippoglossoides limandoides*).

A considerable number of this species were captured, namely 5009, of which only 722, or about 14·4 per cent., were retained in the trawl-net, the remaining 4285 passing through into the outer net; a larger proportion therefore escaping than in the case of the common dab. An examination of the figures in the table will show how few under 6 inches were retained, even with the ordinary mesh of one-and-a-half-inches, namely, only 16·2 per cent. With the 2-inch mesh the percentage captured in the trawl was only 3·2. The long rough dab may attain maturity at a

	Size in Inches.												
	2	3	4	5	6	7	8	9	10	11	12	Above 12	Total.
In Trawl-Net.													
1½-inch mesh	...	6	46	28	117	98	127	40	28	6	8	2	506
1½* ,,	...	...	2	11	23	21	38	35	20	2	...	1	153
2 ,,	...	...	2	4	...	1	...	2	4	...	...	...	13
2½ ,,	...	...	8	9	14	2	3	1	2	1	...	...	40
3 ,,	...	...	...	2	2	...	3	...	1	...	1	1	10
	...	6	58	54	156	122	171	78	55	9	9	4	722
In Outer Net.													
1½-inch mesh	11	4	314	585	484	164	5	...	...	...	...	...	2567
1½* ,,	...	36	255	182	264	108	...	...	...	...	...	...	845
2 ,,	3	50	154	90	63	10	14	2	1	...	...	...	387
2½ ,,	...	8	17	76	174	13	31	3	3	...	...	...	325
3 ,,	...	...	33	46	21	6	43	2	5	5	...	...	161
	14	98	1773	979	1006	301	93	7	9	5	...	...	4285

size even below that for the common dab, males having been found nearly mature when only about three-and-a-half inches in length, and females when only five inches. The same remark may be made respecting this species as was made about the common dab, namely, that in ordinary trawling operations a comparatively large proportion must escape through the meshes of the trawl. It may indeed be said, in regard to both these species, that very few of the immature individuals are captured in the ordinary trawler.

Among other flat-fishes obtained in the course of the experiments were witch soles (*P. cynoglossus*), flounders, turbot, brill, soles, sail-flukes, and solenettes; but the numbers were, as a rule, not large, and frequently inconsiderable. In the experiments with the one-and-a-half-inch meshes twenty-two flounders (*P. flesus*) were taken, from six to thirteen inches in length; none passed through the meshes of the trawl. Only one turbot, three black soles, five brill, and three sail-fluke (*A. megastoma*) were captured, the smallest of which was thirteen inches long, and all were in the trawl-net. Of sixty witch soles from eight

to twenty inches long, only one, eight inches in length, passed into the outer net. The number of solenettes taken was 113, and 110 of them passed through the one-and-a-half-inch mesh; this species would practically escape from the ordinary trawl-net. In the experiments with the larger meshes a number of witch soles and flounders and a few brill were taken; they were retained in the trawl-net. All the skates and rays that entered the trawl were retained, except four starry rays, four inches in extreme breadth, and two thornback rays, five inches in extreme breadth, which passed through the three-inch meshes.

The number of round fishes captured in the series of experiments was, as we have seen, large.

Cod (*Gadus morrhua*).

Of 1661 cod captured, 570, or about 34 per cent., were found in the trawl-net, the remaining 1090 being in the outer net. The details are as follows:—

	Size in Inches.																	Total.
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Above 20	
In Trawl-Net.																			
1½-inch mesh	3	5	14	16	38	60	24	17	50	12	4	6	7	4	8	2	37	60	367
1½* ,,	...	...	...	...	4	...	4	14	11	4	3	2	7	3	4	2	3	6	67
2 ,,	...	...	...	16	...	4	9	13	...	5	2	2	...	3	17	...	6	18	95
2½ ,,	...	...	...	...	...	...	...	...	1	...	...	...	...	2	...	...	1	1	5
3 ,,	2	1	...	1	1	...	...	...	...	1	...	...	...	6	...	...	5	19	36
	5	6	14	33	43	64	37	44	62	22	9	10	14	18	29	4	52	104	570
In Outer Net.																			
1½-inch mesh	128	125	133	111	162	27	1	6	...	...	...	...	...	...	...	...	...	...	693
1½* ,,	...	...	4	9	3	11	...	...	...	...	...	...	...	...	...	...	...	...	27
2 ,,	81	10	31	16	...	24	5	4	2	3	...	...	...	...	...	...	...	...	176
2½ ,,	...	1	...	...	...	1	2	1	2	...	...	...	...	...	...	...	...	...	7
3 ,,	...	27	32		32	22	25	7	13	4	8	...	6	3	...	1	...	...	188
	209	163	200	144	97	85	33	18	17	7	8	...	6	3	...	1	...	...	1091

In the hauls with the one-and-a-half-inch meshes, 720 of the 1154 taken, or about 61 per cent., passed through into the outer net, a few of eleven inches in length and the greater number of eight and nine inches in length, being found in the latter. In the experiments with the two-inch mesh, the proportion was a little higher, and codlings of twelve and thirteen inches passed through. With the three-inch mesh about 84 per cent. escaped through the trawl, and, in this case, some of the fishes were large, one being nineteen inches, and several sixteen and seventeen inches in length.

Haddock (*Gadus æglefinus*).

The total number of haddocks taken was 14,126, of which rather more than half, namely, 7659, or over 54 per cent., were retained in the trawl net. In the experiments with the one-and-a-half-inch meshes, 12,894 haddocks were captured, and of this number considerably more than half were retained in the net. The largest specimens which passed through this mesh were ten inches long, but they were not numerous in proportion to the number of this size retained in the trawl. The majority of those at eight and nine inches also failed to escape from the trawl; but most of

those at seven inches and under did so escape. In the experiments with the two-inch mesh rather more passed through than were retained, but

	Size in Inches.											Total.
	4	5	6	7	8	9	10	11	12	13	14	Above 14	
In Trawl-Net.													
1½-inch mesh	2	...	131	534	3235	1247	492	24	35	10	41	15	5766
1½* ,,	...	...	...	3	179	798	684	84	...	...	...	...	1748
2 ,,	...	...	...	...	28	19	6	...	...	...	1	5	59
2½ ,,	...	...	...	2	3	41	11	...	...	...	...	1	58
3 ,,	...	...	...	3	8	11	4	...	...	...	...	2	28
	2	...	131	542	3453	2116	1197	108	35	10	42	23	7659
In Outer Net.													
1½-inch mesh	4	11	285	1816	2136	775	198	...	...	...	...	...	5225
1½* ,,	...	...	1	18	46	57	33	...	...	...	...	...	155
2 ,,	...	...	1	12	40	20	14	...	...	...	...	...	87
2½ ,,	...	...	...	8	157	85	206	...	8	...	...	...	464
3 ,,	...	...	1	113	284	120	7	6	1	...	2	2*	536
	4	11	288	1967	2663	1057	458	6	9	...	2	2	6467

* One of 17 and the other of 19 inches in length.

the numbers were not large. In this case most of those at nine and ten inches passed through the meshes, and none of seven inches was retained in the trawl. With the two-and-a-half-inch mesh, of a total number of 522 haddocks captured, nearly 89 per cent. escaped through the meshes, a large number of these being ten inches in length and several twelve inches. In the experiments with the three-inch mesh 95 per cent of those which entered the trawl found their way through into the outer net. One of these was nineteen inches, one seventeen inches, and two fourteen inches long.

Whiting (*Gadus merlangus*).

Of the 13,915 whitings captured in the course of the experiments, only 742, or a little over 5 per cent., remained in the trawl-net. In the

	Size in Inches.										Total.
	3	4	5	6	7	8	9	10	11	12	13	Above 13	
In Trawl-Net.													
1½-inch mesh	...	29	27	179	42	50	29	12	31	29	10	12	450
1½* ,,	...	...	13	8	4	3	...	2	2	...	...	...	32
2 ,,	...	37	13	...	8	...	3	4	1	...	...	7	73
2½ ,,	...	2	6	17	29	8	1	...	...	...	...	...	63
3 ,,	...	34	32	32	9	8	7	...	...	1	1	...	124
	...	102	91	236	92	69	40	18	34	30	11	19	742
In Outer Net.													
1½-inch mesh	220	1183	1363	2725	796	1523	96	95	...	...	...	...	8001
1½* ,,	...	...	216	210	131	53	52	9	...	...	...	...	671
2 ,,	320	433	35	141	2	109	51	...	12	8	2	...	1113
2½ ,,	...	9	146	168	2	172	52	12	...	2	1	...	564
3 ,,	...	1370	452	376	373	206	17	7	9	11	1	2*	2824
	540	2995	2212	3620	1304	2063	268	123	21	21	4	2	13,173

* 15 inches.

experiments with the one-and-a-half-inch mesh, about 94 per cent. made their way through the meshes, a number of these being nine and ten inches in length, and the majority between six and nine inches long.

With the two-inch mesh about the same proportional number escaped into the outer net, and some of them were thirteen inches in length, and a considerable number were from eight to twelve inches long. In the experiments with the two-and-a-half-inch mesh only 627 were caught, and about 10 per cent. remained in the trawl-net, the largest being nine inches long. In the outer net the largest was thirteen inches, and a considerable number ranged from eight to ten inches. With the three-inch mesh the great majority passed through, namely, 2824 of a total of 2984 captured. The largest found in the outer net measured fifteen inches in length.

Gurnard (*Trigla gurnardus*).

The number of gurnards captured was smaller than in the cases just dealt with, the total being 1939, of which 854 remained in the trawl-net. In the experiments with the one-and-a-half-inch mesh 1808 were taken, of which 968, or over 53 per cent., passed through the meshes into the outer net. The largest of these measured nine inches, the majority ranging from this size to seven inches.

	Size in Inches.												Total.
	2	3	4	5	6	7	8	9	10	11	12	Above 12	
In Trawl-Net.													
1½-inch mesh	...	...	1	28	171	109	39	68	63	64	32	72	647
1½* ,,	...	...	...	...	3	33	43	30	41	14	17	12	193
2 ,,	...	...	...	...	...	...	...	...	...	...	...	...	...
2½ ,,	...	...	...	...	3	...	4	1	2	...	3	1	14
3 ,,	...	...	..	...	...	...	...	...	...	...	...	...	...
	...	...	1	28	177	142	86	99	106	78	52	85	854
In Outer Net.													
1½-inch mesh	9	25	25	249	324	95	76	37	...	...	...	...	840
1½* ,,	...	4	5	4	42	51	21	1	...	...	...	...	128
2 ,,	...	...	...	1	...	...	...	...	...	...	...	...	1
2½ ,,	5	3	...	6	16	6	39	4	29	2	3	1*	114
3 ,,	1	...	1	...	...	...	...	...	...	...	...	...	2
	15	32	31	260	382	152	136	42	29	2	3	1	1085

* 13 inches.

In the other experiments comparatively few gurnards were caught, except with the two-and-a-half-inch mesh. In this case the greater number succeeded in making their escape, one of them measuring thirteen inches, and the majority ranging from eight to twelve inches.

Respecting some of the other fishes captured, a few remarks may be made. A considerable number of herrings were taken, and all save three passed through the one-and-a-half-inch mesh, the sizes of those which did so ranging from four to nine inches. The three retained in the trawl were four, five, and six inches long. Of 105 sprats all but one passed through the one-and-a-half-inch mesh. The number of specimens of the brassie taken was 137, and 129 of these passed through the one-and-a-half-inch mesh, the largest of these being eight inches long. The largest of the two specimens of ling, which made their way through the one-and-a-half-inch mesh, was ten inches in length.

VIII.—ON THE OVIPOSITION AND GROWTH OF THE LESSER SAND-EEL (*Ammodytes tobianus*, L.). By J. H. Fullarton, M.A., D.Sc., F.R.S.E.

The attempts made in Scotland to obtain the eggs of the sand-eels or ripe sand-eels were for some years unsuccessful. The adults, when caught by means of the seine-net, or by the more familiar plan of cutting through the sand, which they haunt, by a large knife or ordinary shearing-hook, to a depth of six inches or so, were not fully ripe, or there was an absence of ripe females among them. In 1891, I turned my attention to the subject with a view of obtaining, for morphological work, a series of embryos, and, at intervals, I obtained in the spring and early summer specimens of the fully developed adults, without finding any ripe. As the summer approached a perceptible advance towards ripeness was noticed, both in the ovaries and testes. This was the case specially in the Lesser Sand-eel (*A. tobianus*), and also in the Greater Sand-eel (*A. lanceolatus*, Lesauvage), but the numbers of the latter species which were caught were not so large that one could predict the spawning time so accurately as in the Lesser Sand-eel. In the middle of June 1891, the generative products of a few were nearly ripe, and 'running' females and 'running' males were found on the 22nd of June, near the mouth of the Tyne, in Haddingtonshire, and the ova were fertilised by me. But, at this date, only a very small percentage of the adults caught by digging were ripe, and subsequent experience has shown, especially last year, that June is an early date for ripe adults to be obtained. By the 15th of July, in 1891, and last year, however, a large number of gravid females were found amongst the large numbers of the Lesser Sand-eel that were taken.

It is not wonderful that the eggs escaped observation. The habits of the sand-eels are peculiar,—at one time swimming about in immense shoals, and at another burrowing in the sand in the successive zones laid bare by the receding tide. Ripe specimens are very seldom, if ever, found in the hardened sand, *i.e.*, the sand at some distance above the level of the outgoing or inflowing tide, although unripe specimens can be got in the hardened sand which becomes partially consolidated by the withdrawal of the water to a lower level. Invariably the 'full' males and females burrow in the sand along the edge of the water, where the particles of sand are not so close together as higher up on the banks, and also in the sand which is still covered by the water. Besides, I have noticed that ripe males are found further from the sea than ripe females, and this possibly accounts for persons, in search of ripe specimens, obtaining numbers of the former but none of the latter. At any rate, I could always rely at certain times, during the period of lowest spring tides, on securing a number of both sexes with fully developed eggs and sperms. Couch* has described the Launce as shedding its roe, 'as it holds a tortuous course, the grains 'being scattered as it passes on.' This is a very correct prediction, for the eggs in both species seem to be shed very rapidly. The whole of the contents of the ripe ovaries can at once be shed by 'stripping,' so as to permit of artificial fertilisations being made. This affords no support to the conjecture, which one writer has put forward, for 'successive crops or lay-'ings separated by definite intervals for the maturation of the undeveloped 'ova remaining in the ovaries.' The theory of 'successive crops or layings' is not only opposed by the fact that by *gentle* artificial stripping all the

* *Fishes of the British Islands*, vol. iii. p. 133.

products are shed, but also by the large number of completely spent or shotten fish, obtained from June onwards, as the season advances.

As to the time of spawning, authorities, who have dealt with fishes, have differed widely. Day* found 'at St Ives examples of the small sand-'eel, with milt and roe very forward, in the months of August and 'September. Thompson found some ready to deposit their spawn in 'Ireland, at the end of July, but he remarks that in places they do so 'during winter.' Couch † states that, on the West Coast, the spawning process 'is accomplished at about the shortest days of the year.' M'Intosh ‡ says that the greater sand-eel is ripe in the Firth of Forth at Elie, in June and July, and Bloch names May, and Malm June, as the dates when the ovaries are ripe. On the south-east coast of Scotland, so far as I could ascertain from many hundreds of the smaller species examined by me, spawning begins in only a rare number of cases late in June, and, for some weeks thereafter, the proportion of ripe forms gradually increases. In Haddingtonshire the greatest number of spawning females were secured in the latter half of July, but it is extremely likely that the period of the spawning of the species, as a whole, is prolonged into autumn, and even the beginning of winter. This holds good for the lesser sand-eel, but the number examined of the larger species was not sufficient to permit of definite conclusions being formed.

The eggs, which are demersal, are shed below the level of the lowest tides, for the fish are removed from the sand actually emitting the generative products. This may explain why it has been, and practically is, impossible to obtain the fertilised eggs *in situ*. The search would be akin to an enumeration of the grains of sand on the sea-shore. The eggs are adhesive, only in a very slight degree, to one another, and readily affix themselves to any grains of sand present, as well as to the sides of the utensil into which they are expressed from the females. They differ much, in the degree of adhesion, from such eggs as those of the herring and shore fishes, and the egg membrane is very easily ruptured. In this way the removal of the membrane, to permit of subsequent manipulation, is effected without difficulty. When the egg membrane has been accidentally ruptured, as is not unfrequently the case, the embryo continues to live, but, instead of growing in length in a natural manner, like those still *in ovo*, it becomes stunted in shape, the caudal extremity being no longer pointed, but round and blunted. In fact, for the production of monstrosities,—or what might be styled stout dwarfs,—one only requires to rupture mechanically the egg membrane, and so remove the pressure which it exercises on the embryo *in ovo*, to attain this object. As to the eggs, which are in a fit condition to be artifically fertilised, not all fish which yield their eggs by gentle pressure are mature enough, but only those in which the eggs shed are very clear. Both the very clear eggs and the less clear, with a tinge of brown in their yelk, will run quite freely, but only a very moderate amount of success is obtained in the fertilisation of the latter. Good fertilisations were repeatedly got from the first mentioned, but when these were mixed with the moderately successful fertilisation of the darker eggs, the decomposition resulting from the large number of unfertilised eggs eventually destroyed those that were fertilised and segmenting. This may also suggest one of the reasons why the running fish are to be found, not in the hard sand, but in the sand which is very soft, for the pressure on the swollen abdomen of the sand-eels in their passage through the soft sand, is quite sufficient to cause the extrusion of the clear eggs, and the sand-eels must first enter the soft, before reaching the hard, sand. Besides, the necessity for the aëration of

* *British Fishes*, vol. i, p. 333. † *Ut supra*, vol. iii. p. 133.
‡ *Ninth Annual Report*, Part iii. p. 331.

the eggs is more attainable when the quantity of water is not at a minimum. Indeed, it seems as if the sand chosen by the sand-eel for resting-places for its eggs is always below the level of the sea at lowest tides.

Before dealing with a series of specimens, placed in my hands by Professor M'Intosh, I may notice the duration of the hatching process, and the length of the larvæ on emergence from the egg. These specimens only included three, which were normally hatched in July 1891, and two marked 'prematurely hatched,' so that my data are drawn from the specimens hatched at Dunbar by myself. The time necessary for the hatching of the eggs, till the larvæ emerge *naturally* from the enveloping membrane, was about ten days. Some, indeed, were born in nine days, but this was exceptional. On emergence from the envelope the small sand-eels measured (after being fixed in a fixing solution and preserved in alcohol) a little over 3 millimetres in length. None was over 3·5 mm., and the smallest was 3 mm., except some which were freed by mechanical rupture of the enveloping membrane. These exceptional forms were even considerably less than 3 mm., and were the dwarfed forms already noticed. Larvæ were kept till the absorption of the yelk, but the greatest amount of growth recorded for the ten days did not exceed 0·25 mm.

The sizes of my specimens were somewhat less than two of the five hatched ones handed to me by Professor M'Intosh, which were 5 and 4 mm., respectively. These are the only two which have to be considered; two of the remaining three, measuring 2·5 mm., are marked 'prematurely ' hatched,' and therefore correspond to my dwarfed forms obtained by the accidental mechanical rupture of the egg membrane, and the third of 3 mm. was 'removed from the egg.' My specimens, hatched naturally, were from artificially fertilised eggs of *A. tobianus*, L., and there was a considerable number of them, none of them however exceeding 3·5 mm. in length. I cannot account for the divergence in length between mine, when the sizes were so constant that they could not attain the extra 0·5 or 1·5 mm., for some time after hatching. In fact, none of them had attained that size at the date of the absorption of the yelk-sac, nor would attain it, till some weeks afterwards.

In questions of growth, the determination of the rate is, in most instances, the result of a series of conjectures, not of definite knowledge. In these instances, where the determinations are absolute, other factors have to be taken into account, for the fish must be kept in confinement, and only approximations can be made to natural conditions of food, temperature, &c. Increase in weight or in length, therefore, bears a direct relation, especially to the amount of food, &c. Under natural conditions the results may, and doubtless do, differ widely from these obtained from fish removed from their native habitat to closed tanks or vessels with a good or bad supply of water, either gorged with food or perhaps starved, and, generally, with a perceptible difference of temperature. When these factors are recognised, it will be at once seen that calculations of the rate of growth resolves themselves into a series of 'guesses at truth,' more or less accurate or, possibly, inaccurate, and most writers, though they may not plainly state this, by their hypothetical statements and hypothetical conclusions, show nevertheless, that the guessing *is* latently recognised. For this reason I prefer not to deal in tabulated form with calculations as to the probabilities of age, but, after setting forth in chronological order the date of capture, length, &c., of the specimens handed to me, discuss questions of growth in relation to the condition of the generative organs of the adults, spawning, and sizes of larvæ of known age, as ascertained in the course of rearing them from fertilised eggs in the tanks connected with the Laboratory at Dunbar.

LIST OF SAND-EELS with Date of Capture and Length in millimetres. The locality where caught, unless specified, is St Andrews Bay.

1 inch = 25·4 mm. nearly; 1 foot = 304·8 mm. nearly.

Date of Capture.	No. of Specimens.	Length in Millimetres.	Locality and Mode of Capture.
1884.			
May 18	8	10·	Off Isle of May.
1886.			
June 16	1	62·	Left by tide in old boat at St Andrews Harbour.
,,	3	60·	,,
,,	1	59·	,,
1887.			
Apr.	2	14·	
,,	22	12·	At four fathoms depth.
,,	4	11·	,,
,,	50	10·	,,
,,	18	9·	,,
Apr. 1	1	10·	Mid-water net.
,, 14	2	9·	Off Pier Head.
,, 28	4	15·	At four fathoms off West Sands.
,,	10	12·	,,
,,	16	9·	,,
May 5	1	16·	Mid-water net.
1888.			
Mar. 2	1	5·5	
,,	1	5·	
,, 6	3	4·5	At three fathoms.
Apr. 18	1	12·5	Mid-water net.
,,	1	11·	,,
,,	1	9·	,,
,,	2	8·	,,
,,	1	6·	,,
,, 26	1	14·	,,
,, 30	2	14·	,,
,,	5	12·	,,
May 4	1	15·	,,
,,	1	14·	,,
,, 9	1	16·	,,
,, 11	1	10· (tail partly gone)	,,
,,	1	11·	,,
,, 28	5	17·	,,
1889.			
Mar. 12	2	5·	,,
,, 22	11	6·	,,
,,	33	5·	,,
Apr. 1	1	5·5	
May 2	1	5·5	In bottom net.
July 20	6	42·	Burn stools off St Andrews Harbour.
,,	1	41·	,,
,,	5	40·	,,
,,	1	39·	,,
,,	3	38·	,,
,,	3	37·	,,
,,	2	36·	,,
Sept. 5	1	102·	In seine-net at Eden Sands.
,,	2	87·	,,
,,	2	86·	,,
,,	1	85·	,,
,,	1	84·	,,
,,	1	83·	,,
,,	2	82·	,,
,,	6	80·	,,
,,	1	79·	,,
,,	4	77·	,,
,,	1	75·	,,
1889.			
Sept. 5	1	58·	In seine-net at Eden Sands.
,,	1	56·	,,
,,	4	54·	,,
,,	23	52·	,,
,,	1	51·	,,
,,	11	50·	,,
,,	8	48·	,,
,,	2	47·	,,
,,	2	46·	,,
,,	1	45·	,,
,,	10	44·	,,
,,	1	43·	,,
,,	2	42·	,,
,, 7	1	89·	,,
,,	1	85·	,,
,,	1	83·	,,
,,	1	58·	,,
,,	2	52·	,,
,,	3	48·	,,
,,	1	40·	,,
1890.			
Mar. 14	1	5·	In bottom net.
,, 19	1	5·	In bottom net off Castle.
,,	3	4·5	,,
,, 28	5	9·	In bottom net.
,, 29	1	6·	,,
,,	1	3·5	,,
Apr. 24	1	6·	After 17 days in confinement.
May 13	1	15·	In mid-water net.
June	1	43·	
,,	1	41·	
,,	3	40·	
,,	1	39·	
,,	2	37·	
,,	2	36·	
Aug. 1	1	5·5	
,,	1	4·5	
1891.			
Mar. 31	1	11·	In bottom net.
,,	3	10·	,,
,,	2	9·	,,
,,	10	7·	,,
,,	13	6·	,,
,,	37	5·	,,
,,	3	4·5	,,
,,	11	4·	,,
Apr. 14	1	14·	,,
,,	5	12·	,,
,,	1	11·	,,
,,	1	10·	,,
,,	13	9·	,,
,,	46	8·	,,
,,	65	7·	,,
,,	75	6·	,,
,,	40	5·	,,
,, 16	1	10·	,,
,,	5	9·	,,
,,	6	8·	,,
,,	39	7·	,,
,,	9	6·	,,
,,	20	5·	,,
,,	2	4·	,,

Date of Capture.	No. of Specimens.	Length in Millimetres.	Locality and Mode of Capture.
1891.			
Apr. 17	2	10·	Bottom net.
,,	7	9·	,,
,,	6	8·	,,
,,	39	7·	,,
,,	9	6·	,,
,,	20	5·	,,
,,	2	4·	,,
,, 18	4	14·	,,
,,	16	12·	,,
,,	28	11·	,,
,,	64	10·	,,
,,	100	9·	,,
,,	128	8·	,,
,,	176	7·	,,
,,	4	5·	,,
,,	1	110·	,,
,, 26	6	16·	,,
,,	12	14·	,,
,,	84	11·	,,
,,	138	10·	,,
,,	300	9·	,,
,,	456	8·	,,
,,	456	7·	,,
,,	162	6·	,,
,,	6	5·	,,
May 1	1	10·	,,
,,	6	9·	,,
,,	33	8·	,,
,,	53	7·	,,
,,	39	6·	,,
,,	13	5·	,,
,,	4	4·	,,
,, 4	1	10·	,,
,,	6	9·	,,
,,	33	8·	,,
,,	53	7·	,,
,,	39	6·	,,
,,	13	5·	,,
,,	4	4·	,,
July 31	3	12·	Bottom net off west end of Isle of May.
,,	8	10·	,,

Date of Capture.	No. of Specimens.	Length in Millimetres.	Locality and Mode of Capture.
1891.			
Aug. 19	4	3·	Bottom net.
Nov. 27	1	50·	,,
1892.			
Mar. 21	4	6·	,,
,,	32	5·	,,
,, 29	25	6·	
,,	36	5·	
,,	1	4·	
Apr. 16	1	108·	Off East Rocks.
,,	1	102·	,,
,,	2	100·	,,
,,	1	97·	,,
,,	1	95·	,,
,,	1	93·	,,
,,	1	74·	,,
,,	2	64·	,,
,,	3	60·	,,
,,	5	58·	,,
,,	9	56·	,,
,,	4	54·	,,
,,	3	52·	,,
,,	2	50·	,,
Apr. 20	2	10·	In bottom net.
,,	2	9·	,,
,,	16	8·	,,
,,	43	7·	,,
May 25	1	42·	Surface net off Aberdeen.
,,	1	34·	,,
,,	6	32·	,,
,,	6	30·	,,
,,	2	29·	,,
,,	11	28·	,,
,,	2	27·	,,
,,	1	26·	,,
,,	3	25·	,,
,,	5	24·	,,
,,	2	23·	,,
,,	5	22·	,,
,,	3	21·	,,
,,	5	20·	,,

Average Length in millimetres, and Total Numbers of Fish each month in different years.

Year.	March.		April.		May.		June.		July.		August.		September.	
	No.	Length.	No.	Length.	No.	Length.	No.	Length.	No.	Length.	No.	Length.	No.	Length.
1884,	...	...	...	...	8	10·	...	...	...	...	...	...	...	...
1886,	...	...	...	...	...	....	5	60·2	...	...	...	...	...	...
1887,	...	....	4	10·7	1	16·	...	...	...	...	...	...	...	...
1888,	5	4·8	14	9·1	10	15·1	...	...	...	...	...	...	...	...
1889,	96	5·1	1	5·5	2	7·2	...	...	...	...	...	...	101	68·8
1890,	12	6·5	1	6·	1	15·	10	38·9	21	39·4	(2)	(5·)	...	...
1891,	80	5·6	2546	7·9	260	7·7	...	...	11	10·5	(4)	(3·)	...	...
1892,	36	5·1	(36) 63	(65·) 7·4	53	26·5	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Average sizes,	...	5·4	...	7·7	....	13·9	...	49·5	...	24·9	...	...	...	68·8

The statistics only extend over seven months of the year in which young sand-eels were found and preserved, viz., from March to September. In 1890 fish are recorded in each month from March to August, but in 1884 and 1886 they were only obtained in one month, in 1887 in two months, in 1888, 1889, and 1892, during three months, and in 1891 in five different months. Disregarding those obtained in August of 1890 and of 1891, which were evidently developed from eggs hatched within the two previous months, and also those caught on April 1892, averaging 65 mm. in length, which were more than six times the length of the average for April in any year, we notice that the average size of specimens was, in March, 5·4 mm., in April 7·7 mm., in May 13·9 mm., in June 49·5 mm., in July 24·9 mm., and in September 68·8 mm. The low average for July, as compared with June, may be accounted for by the specimens in 1891 being in May 7·7 mm., and in July only 10·5 mm., as compared with 15 mm. and 39·4 mm., respectively, in 1890. It would have been interesting to have the measurements of sand-eels during the first two months of the same years in which specimens were caught in March, but I have not seen any caught in these months. To argue that there is none in January and February between 3 mm.—the lowest size recorded—and 5·4 mm. of March, would be rash, and is probably the reverse of the truth. All that can be said is, that the appliances of capture were insufficient, or that there is something different in the habit of the specimens under 5 mm. from that of slightly larger forms. The smaller specimens were obtained by means of a large mid-water net, or by a bottom net. Having regard to the fact that only a little over 200 in ten hauls were caught in this way, and that the young sand-eels, so far as known, are born close inshore, near to the low-water mark, it is not wonderful that the smaller specimens under 5 mm. are almost entirely absent from the record. Moreover, from the character of the sand-eels examined, it is evident that those of 5 mm. are of considerable age. Before the commencement of the spawning time, so far as determined by me for Haddingtonshire sand-eels, the earliest record of 5 mm. examples having been taken was on 2nd March, and the last appearance was on 1st May, or fully six weeks before any ripe females, out of very large numbers whose reproductive organs were examined, could be found. The question, therefore, naturally arises, when were these small specimens of March and April spawned? From what we know of the size of the larvæ on emergence from the egg, and the length of the period necessary for the absorption of the yelk, as well as from the rate of growth during the larval period between these two dates, the date of spawning must be placed in the previous year. On 29th March 1890 one measured 3·5 mm., and on 29th March 1892, one measured 4 mm., but these are exceptions, and, like many found in some fertilisations, may have lagged in the race of growth, and they may be as old as 6 mm. specimens captured on the same days. How long may it take a sand-eel of 3·5 mm. to grow 2·5 mm. in the coldest months of the year, when, in ten days in the hottest months of the year, the increase of growth in that time is only 0·25 mm. for the same size of fish. If this rate of growth were constant from 3·5 mm. to 6 mm., sand-eels of the latter size would be upwards of three months of age, but, as the observed rate of 0·25 mm. is for larvæ in water of at least double the temperature centigrade that is found in the neighbourhood of St Andrews Bay in winter, the sand-eels may be much older than three months, and may even be six months old. It is known that skate embryos scarcely make any progress in growth during the colder months of the year, but that so soon as the temperature of the water rises towards summer, they begin to grow rapidly. From an examination of skate eggs, taken from adults in December and April,

I have noticed that in June and July the later embryos—two or three months old—are practically as far advanced as those four or five months older. In other words, cold water retards the growth of skate embryos, and, in a like manner also, the hatching of Teleostean eggs; either may be hastened or retarded. In plaice, hatched by me at Dunbar, in January 1890, the young were not born till sixteen days after fertilisation, while elsewhere* in April they took only eleven days to arrive at the same stage. The difference of temperature of the sea between these two months is considerable, but not generally more that 3° or 4° centigrade, and yet eggs in the colder water take a half longer time to hatch than eggs in the warmer water. But this retardation holds good, not only for embryos *in ovo*, but also for the larvæ during the period when the absorption of the yelk is proceeding, and also immediately after the larvæ begin to consume food. I have noticed this difference in the rate of growth chiefly in the grey skate, among cartilaginous fishes, and in the plaice amongst Teleosteans, and also, in a minor degree, in the lesser sand-eel, which hatched more slowly in June 1891 than in the end of July and August 1893. The phenomenon of retardation or, on the other hand, of hastening of development, is a well-known fact in the case of the Salmonidæ, and was particularly observed by Mr Jamieson in reference to herring eggs, which he started with from this country for New Zealand, but which hatched *en route*, owing to faulty engineering arrangements. There is, therefore, strong presumptive evidence that the sand-eels of 5 mm. and 6 mm., caught in the months of April and March, are the products of the late spawning of the previous season, and that their development has been retarded by the increasing coldness of the sea during the winter and early spring.

If these small sand-eels are not from eggs shed in the early part of the year, are they from eggs laid in the winter, and have individual sand-eels two or more periods of spawning, separated by distinct intervals in each year? Sand-eels may spawn twice in the year, but, considering the large numbers of ripe forms, obtained from June onwards till well on in autumn, it is scarcely necessary to conclude that the sand-eel spawns twice in the year in order to account for the presence of the small forms in spring. Besides, this prolonged time, during which eggs or larvæ are obtainable, is in accord with the spawning periods of other Teleosteans. Ripe eggs of many of our food-fishes can be got during three or four months of the year. In reference to the sand-eel, while some spawn as early as the latter part of June, others spawn two, or even three, months afterwards, and possibly some very late in autumn, or even in the beginning of winter, so that the small examples obtained in March and April may be five months of age, an estimate purely conjectural, but which does not do violence to that of the rate of growth ascertained for summer, with the correction for retardation when the medium in which they live is only about half the temperature centigrade of the temperature when the rate of growth was ascertained. The duration of the spawning period of the lesser sand-eel may therefore be set down as from the end of June till October.

The spawning period varies with the season. In a season when the sea is warm spawning takes place earlier than when the weather is colder. The recognition of a difference in the date of spawning helps one to understand why the sizes, especially in April and May, vary so much. Taking, for example, the year 1889 as compared with the previous year, the sand-eels caught in April and May are only about half the size of those caught twelve months previously. If the

* M'Intosh and Prince.

numbers were sufficiently large one might determine the average size of the sand-eels, less than one year old, which are caught in these months, for the larger the number the less would be the likelihood of error in coming to a conclusion with an approximation to accuracy. In March the size is fairly constant, the difference between the lowest and highest averages for the years 1888–1892 only amounting to about 30 per cent. In April the averages fluctuate between 5·5 mm., which is exceptionally low, and 10·7 mm. This does not take into account thirty-six sand-eels of an average size, which seem to belong to an earlier brood. These at most cannot be older than those spawned in the previous June, *i.e.*, nine months old, and might likely not be spawned till some time later. In September 1889 the average was 68·8 mm. and, according to the preceding data, would likely be eleven months old. The size, 65–70 mm., might therefore be attained by the first year's sand-eels in 9–11 months. Those captured in March, April, and May, with the exception of those of 65 mm. average length already noticed, may be considered as having been hatched towards the latter part of the previous spawning season, although those obtained off Aberdeen, on 25th May 1892, are seemingly somewhat older than those captured at St Andrews in the end of the previous month, which ranged from 10 mm. to 7 mm. Taking the first three months, and comparing the average sizes of these caught in each month, we may obtain an index of the rate of growth of sand-eels from a little over 5 mm. to nearly 14 mm. From 5·4 mm. sand-eels of March, the rate of growth to attain a size of 7·7 mm., in April, is 42 per cent. of the total length, and the rate of growth of April forms up till May amounts to 80 per cent. That sand-eels grow very slowly, during the early larval stages in confinement, has been ascertained, and that the rate of growth during larval and post-larval stages is not the same may be at once conceived, for, in observations made by Mr Jamieson at Dunbar, especially in regard to the Pleuronectidæ and the viviparous blenny, it was noticed that, as the young fish advanced in age after the post-larval stages, a great increase in the rate of growth was a marked feature. This held good for the flat fishes for many months after their eyes came to be placed on the same side. The averages of 42 per cent. and 80 per cent. would, therefore, not be inconsistent with the increase observed in reference to the growth of young fishes generally.

IX.—ON THE ANATOMY OF THE PECTORAL ARCH OF THE GREY GURNARD (*Trigla gurnardus*), WITH SPECIAL REFERENCE TO ITS INNERVATION.* By H. Charles Williamson, M.A.,B.Sc., Marine Laboratory, St Andrews. (Plates XIII–XV.)

The genus Triglidæ have attracted the attention of zoologists from the time of Bloch, who probably was the first to offer a suggestion as to the use of the free pectoral filaments, the possession of which has marked this group off from other fishes. The free rays are very flexible, and when drawn forward stand out at right angles to the side of the body. At the same time, the distal half of the ray is bent vertically downward. When in this position, the tips of the rays are moved backwards and forwards over the bottom. That these rays functioned as organs of sensation, was demonstrated by Tiedemann,† in the case of *Trigla adriatica*. He showed that they had a large nerve supply. Another marked characteristic of the gurnard family is the presence of ganglionic swellings on the beginning of the spinal cord. The nerves supplying the pectoral arch arise from the swellings.‡

While the Triglidæ is the only group of fishes in which there are rays quite detached from the fin, still there are a number of fishes in which certain of the rays, of either the pectoral, or pelvic fins, end in free filamentous tips. The amount of separation of the fin-ray from the rest of the fin varies much in different fishes. In *Cottus scorpius*, *Cottus bubalis*, *Blennius pholis*, and no doubt many other bottom-feeding fish, the lower rays of the pectoral fin are free at their tips. The pectoral fins in these forms are very large, and when the fish is at rest on the bottom, are spread out at its side. These fishes, it has been noticed, rest on the bottom on the small pelvic and anal fins, and are propped up, as it were, by the expanded pectorals. In *Zoarces viviparus* the pectoral fin is very large and flexible, but the separation between the fin-rays is very slight. In some fishes it is found that certain of the pelvic, instead of the pectoral, fin-rays are filamentous. *Motella tricirrata*, *M. mustella*, *Raniceps raninus*, and many others, are examples of this class. It has been noted that, in many fishes which have comparatively broad heads, and in which the eyes are situated high up on the head, some of the fin-rays of either the pectoral or pelvic fin are filamentous. From the position of its eyes, the fish is unable to see objects of prey close to itself. It therefore depends on organs of touch for aid in the capture of its food.

In the case of the gurnard, writers on the subject have agreed that the fin-rays are sensitive, but one zoologist, Deslongchamps,§ has maintained that they also have a mechanical action. He had the opportunity of watching some gurnards which were confined by means of a net in shallow water. He states that he observed the gurnards marching about on the fin-rays, and also stirring up the sand by means of these structures. Dr Harrison Allen‖ says, 'in directing the body towards the right the left filaments 'are in constant motion, while the right filaments are at rest. In directing

* I am indebted to the Rev. E. J. S. Teviotdale, M.A., B.Sc., for the use of his notes on the Free Filaments of the Grey Gurnard.

† F. Tiedemann, 'Von dem Hirn und den fingerformigen Fortsätzen der Triglen,' *Deutsches Archiv. für die Physiologie*, T. F. Meckel, Band II., 1816.

‡ Cuvier and Valenciennes, *Histoire Naturelle des Poissons.*

§ Deslongchamps, *Mem. Soc. Linn. de Normandie*, tome vii. 1843.

‖ Dr Harrison Allen on the 'Pectoral Filaments in the Sea-Robin (*Primotus palmipes*),' *Proceed. Acad. Nat. Science, Philadelphia*, 1885, p. 377.

'the body towards the left, the motion thus described is reversed.' It was noticed that gurnards in the tanks at the St Andrews Marine Laboratory rested, when at the bottom, on the expanded pelvic and anal fins. The free-rays are drawn forward, barely touching the bottom, and, apparently at least, supporting none of the weight of the fish. That they are used as walking organs, to the extent described by Deslongchamps, is doubtful. Bloch, according to Tiedemann, suggested that the free-rays may be lures to attract prey. They are so flexible that the least weight causes them to double up. From the very large nerve supply of the free-rays, these appendages are undoubtedly specially adapted for sensation. Their length and slender nature render them inadequate organs for supporting the weight of the fish, or of stirring up the sand to any depth. In order to bring the free-ray into its position at right angles to the body, three actions must take place. The ray must be drawn forward, turned on its own axis through an angle of 90°, and flexed. The flexion of the ray, (which will be referred to below), is partly automatic. When the free-ray is drawn forward, the proximal half of the ray projects at right angles to the side of the body, while the distal half is bent vertically downwards. A very slight pressure on the tip causes it to bend inwards, and there is little reason to suppose that these rays could sustain the weight of the body without doubling up. It is not simply as organs of touch, however, that the free-rays are of interest; the motions of which they are capable are very complicated. In the early life of the gurnard the free-rays are united to the pectoral fin, and are almost identically similar to the other fin-rays. This is seen in fig. 8, Plate IV., which is a transverse section of the pectoral fin of a gurnard about half an inch long; 12, 13, and 14 are the future free-rays. Each fin-ray consists of two half-rays. When the gurnard is about an inch long, the three ventral rays of the pectoral fin (12, 13, 14, *ib.*) split off and become the free filaments, while the remaining eleven fin-rays remain as the pectoral fin.* As one would expect, from the homology of the free-rays with the fin-rays, we find that the muscular system and the nerve supply of the free filaments is similar to those of the fin-rays; but in the former the nerves and muscles are much the larger.

The Pectoral Arch.

The *Pectoral Arch* agrees with the typical arch in Teleostean fishes. Fig. 1, Pl. XIII. shows the external, and fig. 4, *ib.* shows the internal surface. The *clavicle* (*cl*, figs. 1 and 4, *ib.*) is a large curved bone directed downwards and forwards; it articulates dorsally with the *supra-clavicle* (*s.cl*, *ib.*), and ventrally at *ar*, fig. 4, *ib.*, with the pelvic arch. The upper half of the clavicle makes an angle of about 135° with the lower half. The outer free edge of the clavicle (*l*, fig. 1) is bent backwards, forming an arch which covers part of the *abductor* muscles of the fin and free rays. The inner surface of the clavicle (*i*, fig. 4, *ib.*) is slightly concave. A part of the anterior edge of the lower portion is turned slightly inwards, the posterior edge of the same extends backward over the *coracoid* (*co*, fig. 4, *ib.*). Dorsally, the clavicle is flattened out into a large plate bearing a spine which is directed backwards and upwards (figs. 1 and 4, *ib.*). To the internal surface of this plate the *post-clavicle* (*p.cl*, fig. 4, *ib.*) is loosely attached. The dorsal extremity of the clavicle ends in two sharp processes (fig. 4) through the notch between which the tendon connecting the supra-clavicle to the vertebral column passes (*T*, *ib.*). The supra-clavicle (*s.cl*, figs. 1 and 4, *ib.*) is an elongated flat bone, rounded at the lower extremity. The rounded end fits into a depression in the expanded

* M'Intosh and Prince, *Development and Life-Histories of Teleostean Fishes.*

portion of the clavicle just below the notch (fig. 1). The *scapula* (*s*, figs. 1 and 4) is a flattened bone, roughly semicircular in shape. In the centre of this bone is a large foramen (*F*, *ib.*) through which passes the main trunk of the united I and II spinal nerves (*a*, fig. 15, Pl. XIII.). The scapula is fused anteriorly with the posterior surface of the clavicle; ventrally it articulates with the cartilaginous plate lying between the scapula and the coracoid (*cp*, figs. 1 and 4), and with the first and second *basal elements* (*c*,*c*, *ib.*). The basal elements (*c*,*c*,*c*,*c*, *ib.*) are flattened bones, the first of which—the most dorsal—is the only one found to have a foramen (*f'*, *ib.*). The first of the basal elements is triangular, the remaining three square, in shape. The 2nd basal (*ib.*) articulates above with the scapula and 1st basal—in front with the cartilaginous plate and below with the 3rd basal; the 3rd basal articulates with the 2nd basal, the cartilaginous plate, and 4th basal; the 4th basal articulates with the 3rd basal and coracoid. The coracoid (*co*, figs. 1 and 4, *ib.*) is an arched bone of somewhat triangular shape. It articulates dorsally with the cartilaginous plate, and behind with the 3rd and 4th basals. The anterior edge of the coracoid is fused with the posterior surface of the clavicle, at the top and bottom, the intermediate portion being quite free. The articulation of the basal elements with the bones next to them is fairly loose, and permits of a small outward and inward movement. There is a large foramen (*f*, *ib.*) in the coracoid, through which passes the nerve (*l*, figs. 23 and 27, Pl. XIV.) which supplies the *abductor depressor* muscles of the free-rays. The post-clavicle (*p.cl*, figs. 1 and 4, Pl. XIII.) is a long slender bone curved backwards. The pectoral fin (*p.f*, *ib.*) articulates with the scapula, the 1st, 2nd, and 3rd basals. It is held in place by ligaments attached to these bones and the bases of the fin-rays. The number of rays in the pectoral fin is eleven. Each *fin-ray* in this, as in other fishes, is divisible longitudinally into two parts, an outer and an inner half-ray (*o* and *i*, figs. 8 and 5, *ib.*), which are, except at their proximal ends, almost exact counterparts of each other. Their proximal ends are separate, but their distal extremities are united. They may, however, be easily torn apart. The base of the outer half-ray ends in a small round knob (*ar*, fig. 8), which serves for articulation with the basal element. The base of the inner half-ray has a large flattened process (*b*, fig. 7, *ib.*) which projects downward at right angles to the ray. This process varies in size in different rays (*vide* fig. 7). Eight of the fin-rays, viz., the 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, and 9th, are bifurcated at the tip (*ib.*). This bifurcation is not due to the separation of the two half-rays, but is caused by the longitudinal splitting of both the half-rays. The fin-ray is thus split longitudinally into four. One division of the outer half-ray, together with one division of the inner half-ray, form one tip; the remaining two divisions form the second tip. A cross-section of the two tips of the 7th pectoral fin-ray (left side) is shown in fig. 10, Pl. IV., *c* and *c''*, *ib.*, are the divisions of the outer half-ray, *c'* and *c'''* the divisions of the inner. The large nerve (*x*, fig. 19, Pl. XIV.) which supplies the fin-rays, passes vertically downwards through the bases of the rays, between the outer and inner half-rays. This nerve arises from the I and II spinal nerves, and is the largest nerve which passes through the foramen in the scapula. On the base of each ray are roughened areas for the insertion of muscles. The 1st, 6th, and 11th pectoral fin-rays are shown in figs. 6, 8, and 12, Pl. XIII. The first (fig. 6) is distinguished from the other fin-rays by the possession of a thick irregular process on the base of the inner half-ray, into which are inserted two large muscles (*y*, fig. 19, Pl. XIV., and $p.dr_1$, fig. 11, Pl. XIII.). The former muscle tends to cause the divarication of the fin-rays. The hollow in the end of the fin-ray, between the proximal extremities of the half-rays, receives the

posterior edge of the basal element. All the fin-rays are jointed, but, nevertheless, are very rigid. The *free-rays* (figs. 2, 5, 9, Pl. XIII.) are similarly constituted to the fin-rays. They are jointed and, in contradistinction to the fin-rays, are very flexible. The two half-rays are fastened together at their distal extremities for about a third of their length, but are quite separate at their proximal ends. The inner half-ray (I., fig. 2, *ib.*) ends in a long hooked process. At the base of this process there is a triangular-shaped expansion, into the apex of which is inserted one of the *adductor muscles* (*lr'*, fig. 16, *ib.*). The head of the outer half-ray is a rounded knob, which, with a pit in the basal element (fig. 1, *ib.*), forms a ball-and-socket joint. The socket for the articular head of the 1st free-ray is in the 3rd basal; the sockets for the 2nd and 3rd free-rays are in the 4th basal. The muscles are inserted into roughened areas on the bases of the rays. The rays and bones of the pectoral arch, with the exception of the cartilaginous plate, the three lower basal elements and coracoid, are well ossified. The basal elements and the coracoid are only partially cartilaginous. Eudes-Deslongchamps * examined the pectoral arch of one of the *Triglidæ*. (He does not mention the species.) From his drawing the following points of difference—between the pectoral arch of this form and that described above—are noted:—The clavicle differs very much, in the shape of its lower portion, from that of *T. gurnardus*. Each f the basal elements is pierced by a foramen. Of the fin-rays, the first, *i.e.*, the most dorsal, alone is jointed. Several of the fin-rays have four, and one has five tips. None of the fin-rays of the grey gurnard have more than two separate tips, although each of these tips is composed of two of the four longitudinal divisions of the fin-ray (fig. 10, Pl. IV.).

The Myology of the Pectoral Arch.

The myology of the pectoral arch of one member of the family *Triglidæ* has been pretty fully described by Deslongchamps. The gurnard which that writer examined was not *Trigla gurnardus;* and, although on the whole, the muscular system resembles that of *T. gurnardus*, still it differs materially in several respects. There are two main sets of muscles,—one set on the external surface of the pectoral arch, the other on the internal surface. From the fact that the rays, which are free in the adult, at one time formed part of the pectoral fin, one infers that each of the free-rays will be provided with exactly the same number of muscles as each fin-ray. This is found to be the case.

External Muscles of Pectoral Fin and Free-Rays.—The external m consist of two layers of *abductor* muscles—a superficial layer just be the skin, and a deep layer lying between the former and the arch. superficial muscles, equal in number to the rays (*psp*, *sp'*, *sp''*, *sp'''*, fig. 22, Pl. XIV.), arise from the posterior surface of the clavicle, within the arch formed by the reflected outer edge of that bone. They are directed obliquely backwards and downwards, and are inserted into the anterior border of the outer half-ray (*ib.* and *sp*, figs. 6 and 12, Pl. XIII.). The superficial abductor muscles of the free-rays (*sp'*, *sp''*, *sp'''*, fig. 22, Pl. XIV.) are similar in direction and insertion (*sp'*, fig. 3, Pl. XIII.) to those of the fin-rays, but are very much larger. The muscle of the third free-ray has two heads (*sp'''* and *sp*^{iv}, fig. 22, Pl. XIV.). The superficial abductor muscles draw the fin and free-rays forward and upward, and may therefore be termed *abductor levator* muscles. The more dorsal rays of the pectoral fin have a freer antero-posterior motion than the more ventral rays. When

* *Memoire de la Société Linnéenne de Normandie*, tome vii. 1843.

the fin is drawn forward, therefore, the first fin-ray is brought into a position in advance of the rest, and each fin-ray is in advance of the ray immediately below it. The fin is thus inclined obliquely forwards and upwards. All the tendons of the superficial abductors (or abductor levators) are joined together by a strong ligamentous fascia (*l*, fig. 18, Pl. XIV.). The deep abductors (*pdp*, *dp'*, *dp''*, *dp'''*, fig. 19, Pl. XIV.) lying immediately beneath the preceding are also equal in number to the rays. These muscles, which arise from the lower portion of the posterior surface of the clavicle, are directed backwards and very slightly upwards, to be inserted into the lower surface of the small tubercle on the base of the outer half-ray (*dp*, fig. 6, Pl. XIII.). The most dorsal of the deep abductors of the pectoral fin (*i.e.*, the muscle of the 1st fin-ray) (*y*, fig. 19, Pl. XIV.) is the largest of these fin muscles, and has two heads. Its broad tendon passes over the edge of the scapula, and is inserted into the large irregular projection on the base of the *inner* half-ray (*dp*, fig. 6, Pl. XIII.). By its contraction this muscle causes the rays of the pectoral fin to divaricate. The other deep abductor muscles tend to draw the fin-rays and free-rays forward, and to slightly depress them. In contradistinction to the abductor levator muscles, the deep layer of muscles may be termed *abductor depressor* muscles. The abductor depressors (*dp'*, &c., fig. 19, Pl. XIV.) of the free-rays run parallel to those of the fin, and are inserted into the lower surface of the tubercle on the outer half-ray (*ib.* and fig. 2, Pl. XIII.). These muscles tend, in addition, to cause the free-rays to rotate on their own axes.

Internal Muscles of the Pectoral Fin and Free-Rays.—There are two layers of internal or *adductor* muscles, as in the case of the external or abductor muscles. There is, however, one very important difference. The innermost layer (*pir*, fig. 8, Pl. XV., *pir*, fig. 10, Pl. XIII.) appears to consist of muscles equal in number to the fin-rays and free-rays. They arise from the internal surface of the expanded portion of the clavicle bearing the spine. They are directed almost vertically downwards, slightly forwards, and are inserted into the posterior border of the inner half-ray. Each of these apparently simple muscles really consists of two muscles, inserted close together, into the base of the same ray. The muscles of the free-rays are very large, and are easily separated. The more internal (*ir'*, fig. 14, *ib.*) muscle of the two lies in a groove in the muscle accompanying it (*lr'*, fig. 23, Pl. XIV.). Deslongchamps describes the muscles of the free-rays as double, but does not mention the fact that the muscles of the pectoral fin-rays are also double. For the sake of convenience, the two muscles of each ray may be designated anterior and posterior muscles. The anterior (lr_1, lr_2, &c.) and posterior muscles (ir_1, ir_2, &c.) of the 2nd, 3rd, 4th, 5th, and 6th fin-rays are shown in fig. 17, Pl. XIII. These muscles are not seen when looking at the internal surface of the pectoral arch. They occupy a position almost vertically above the fin, and are seen on removing the skin below the expanded portion of the clavicle. The corresponding muscles of the 6th, 7th, 8th, 9th, 10th, and 11th fin-rays are shown in fig. 14, Pl. XIII. No muscle was found for the 1st pectoral fin-ray, but the tendons of the muscles of the 2nd fin-ray were attached by ligamentous fascia to the inner half of the 1st fin-ray. These muscles are inserted just behind the expanded portion of the inner half-ray (*lr*, *ir*, fig. 12, Pl. XIII.). The action of all these muscles of the pectoral fin-rays is to raise the fin, as well as to bring the fin back to its position alongside the body. They may therefore be termed *adductor levator* muscles. The two muscles of each fin-ray may be referred to as anterior adductor levator (*lr*, fig. 14, Pl. XIII.) and posterior adductor levator (*ir*, *ib.*) respectively. The anterior and posterior adductor levators of the free-rays, unlike the corresponding muscles of the fin-rays,

act separately. They arise just below the notch in the upper part of the clavicle (fig. 10, Pl. XIII.). The posterior adductor levator of the 1st free-ray has a double origin (*ir*, *ir'*, *ib.*), and is inserted into the superior surface of the inner half-ray along the base of the triangular expansion (*ir*, fig. 3, *ib.*). The anterior adductor levator (*lr*, *lr'*, figs. 10 and 16, *ib.*), lying beneath the preceding muscle, is inserted, by means of a long slender tendon, into the apex of the afore-mentioned triangular expansion. This muscle tends to rotate the ray into the position it occupies when drawn forward at right angles to the body. When in this position the ray has been rotated on its own axis through an angle of 90°. The posterior adductor levator causes rotation in the opposite direction.

The second layer of internal muscles, the adductor muscles proper, are horizontal in direction, and are inserted into the triangular expansions on the inner halves of the rays. The adductor muscles of the pectoral fin are shown in fig. 11, Pl. XIII. The muscles of the first three fin-rays arise from the inner surface of the clavicle. Unlike the rest of the muscles, the 1st and 2nd do not have tendons, but are inserted directly. Some of their fibres receive origin from the flat bones lying beneath the muscle. The first adductor is inserted into the large process on the inner half-ray opposite the insertion of abductor depressor (*dp*, fig. 6, Pl. XIII.). The 3rd muscle (pdr_3, *ib.*) has two distinct origins (dr_1 and dr_2, fig. 15, *ib.*). A few fibres of this muscle arise from the posterior surface of the clavicle. In the other muscles the two origins become more and more distinct, until, in the 11th muscle, they are quite separate (dr_1 and dr_2, fig. 13, *ib.*) This muscle practically consists of two muscles, having a very short common tendon. Of the lower eight muscles, the fibres which arise from the clavicle arise from its posterior surface, and not from its inner surface. In the case of several of the muscles, *e.g.*, the 3rd (fig. 15, Pl. XIII.), some of the fibres which arise from the basals are inserted directly alongside the insertion of the tendon of the rest of the muscle. When the homologous muscle of the free-ray is examined, we find a complete separation into two muscles, one muscle corresponding to the clavicular origin of the muscle of the fin-ray (*e.g.*, dr_2, fig. 15), the other, lying beneath the preceding, corresponding to the superior origin (*e.g.*, dr_1, *ib.*). There are thus two layers of adductor muscles attached to the free-rays. The upper layer (*dr'*, *dr''*, *dr'''*, fig. 24, Pl. XIV.) arise from the coracoid, and are inserted into the hooked process on the end of the inner half-ray. The first of these muscles has a double origin. The lower layer of adductors (*or'*, *or''*, *or'''*, fig. 23, *ib.*) arise from the anterior edges of the 3rd and 4th basals, and the coracoid respectively, and are inserted into the base of the hooked process (*or'*, fig. 2, Pl. XIII.). The action of the two muscles of each ray is to cause the flexion of the ray. The flexion of the free-ray seems to be performed automatically. They cannot be drawn forward without being flexed. Deslongchamps thus describes the action of these muscles:—'These muscles, when they act alone, draw the free-'rays to the body; but when the opposing external [abductor] muscles 'contract, they then draw the inner half-ray inwards. But the latter, 'bound to the outer half-ray by its posterior extremity, forces the latter 'to bend in the middle. Then as these two pieces of the free-rays cannot 'separate much from one another, even in the middle, the inner half-ray 'of necessity bends at the same time as the outer. They play, so to 'speak, the same *role* as the tendons of the flexors of the fingers, held by 'their sheaths against the phalanges, which are here represented by the 'outer piece of the ray. This is a mechanism very simple and singular, 'of which there is not, I believe, another example in any animal.' These two layers of muscles may be termed *inner adductor flexor* muscles and *deep adductor flexor* muscles respectively, of the free-rays. A similar

action takes place in connection with the pectoral fins, but the flexion is exceedingly slight. A muscle which arises from the posterior surface of the clavicle is inserted into the lower corner of the 4th basal (*x*, fig. 23, Pl. XIV.). By its contraction, this muscle causes a slight flexion of the basals.

Nerve Supply.

The motor and sensory nerve supply of the pectoral arch is derived from the ventral branches of the first three spinal nerves, as is usual in osseous fishes. These three nerves are seen on the removal of the peritoneal lining of the body cavity. On the beginning of the spinal cord are five ganglionic swellings, under which the nerves supplying the anterior extremity arise. A longitudinal section of the spinal cord through these swellings is shown in fig. 13, Pl. IV. The 1st spinal nerve arises by two roots (*A* and *B*) from beneath the first ganglionic mass (*g'*, *ib.*); the 2nd spinal nerve arises from beneath the second ganglion (*g''*, *ib.*); and the 3rd spinal nerve from beneath the third (*g'''*, *ib.*), and the anterior half of the fourth ganglion (g^{iv}, *ib.*). The 1st spinal nerve emerges from the vertebral column between the skull and first vertebra; the 2nd spinal nerve between the first and second vertebræ; the 3rd spinal nerve between the second and third vertebræ. The ventral branches of the 1st and 2nd spinal nerves (fig. 28, Pl. XIV.) pass round the anterior and posterior sides respectively, of the tendon (*T*), which joins the supraclavicle to the junction of the vertebral column with the skull. They then unite, forming an intricate plexus (fig. 1, Pl. XV.). This plexus, as seen from within the body cavity, is shown in fig. 6, Pl. XV.; the obverse of the preceding is shown in fig. 7, *ib.* The nerves have been separated to show the relation of the branches. The 3rd spinal nerve (III., fig. 3, Pl. XV.) runs alongside the united 1st and 2nd spinal nerves, and one of its branches (*M*, *ib.*) crosses over the trunk formed by their union. A small nerve, the *hypoglossal* nerve (*hg*, *ib.*, and figs. 1, 6, and 7, Pl. XV.), arises from the *Medulla oblongata*. It gives a branch to the united 1st and 2nd spinal nerves. The 1st spinal nerve divides into one large and two small branches; the 2nd spinal nerve divides into one large and five small branches. The large divisions of each of these nerves fuse completely, forming the larger of the two nerves composing the trunk *a*, (fig. 1, Pl. XV.). The smaller divisions run alongside each other, and do not unite except in the case of branch *c* of the 2nd nerve, which fuses with one of the branches of the 1st (fig. 7, Pl. XV.). The nerve trunk *a* supplies the abductor muscles of the pectoral fin, and furnishes part of the sensory nerve supply of the pectoral fin and free rays. The 1st and 2nd spinal nerves are partly motor and partly sensory in function. The 3rd spinal nerve is mainly sensory in function. It, however, supplies the inner and deep adductor flexor muscles of the 2nd and 3rd free-rays, the anterior and posterior abductor levator muscles of the 3rd free-ray, and the abductor depressor muscles of the free-rays. The 3rd spinal nerve (figs. 3 and 8, Pl. XV.) is internal to the 1st and 2nd spinal nerves, and is soon divided up into a number of branches (*p*, *q*, *J*, *M*, *L*, *N*, figs. 3 and 8, Pl. XV.). These nerves lie on the adductor levator muscles of the pectoral fins (*pir*, *ib.*) and of the free-rays (*ir'*, *ir''*, *ir'''* fig. 8, *ib.*). All these nerves, with the exception of *M*, are sensory in character. The nerves marked *p*, *q*, and *a* are distributed to the ventral seven pectoral fin-rays. The free-rays receive their nerve supply from the branches *H*, *S*, *M*. Nerve *p* breaks up into four small twigs, each of which passes between the tendons of the adductor levator muscles of the fin-rays into the space between two fin-rays. Each of these nerve twigs, when it enters the space between two fin-rays, divides

into two branches, one of which runs along the lower surface of the ray above, while the other runs along the upper surface of the ray below the space. In this manner nerve *q* supplies the lower surface of the 9th fin-ray and upper surface of the 10th fin-ray. Nerve *r* supplies the lower surface of the 10th fin-ray and upper surface of the 11th (figs. 8, 2 and 5, *ib.*). Nerve *S* is homologous with the preceding nerves, supplying, as it does, the little nerve *a* to the lower surface of the 11th fin-ray, and the main trunk (*S*, *ib.*), to the upper surface of the 1st free-ray. Nerves *H* and *I* form a plexus (fig. 10, Pl. XV.), from which arise three nerves, the nerve *S*, just mentioned, nerve *T*, which becomes the large nerve on the lower surface of the 1st free-ray (fig. 5, *ib.*), and nerve *U*, which runs along the upper surface of the 2nd free-ray. The large nerve on the lower surface of the 2nd free-ray is furnished by nerve *V*, a branch of the nerve *H* (figs. 8 and 5, *ib.*). Both upper and lower surfaces of the 3rd free-ray are supplied by the nerve *M* (fig. 8, *ib.*). This nerve divides into two branches, *m* and *n* (figs. 5 and 2, *ib.*). Of these, nerve *n* runs along the lower surface of the 3rd free-ray (fig. 5), while *m* passes through between the two half-rays, and supplies the upper surface of that ray (fig. 2, *ib.*). The large nerves on the upper and lower surfaces of the free-rays are double. Nerve *p* (fig. 8, Pl. XV.), then, supplies the lower surface of the 5th fin-ray, the upper and lower surfaces of the 6th, 7th, and 8th fin-rays, and the upper surface of the 9th. Nerve *q* (fig. 4) supplies the lower surface of the 9th and the upper surface of the 10th fin-ray. The lower surface of the 10th and the upper surface of the 11th are supplied by the nerve *r* (*ib.*). The lower surface of the 11th fin-ray and upper surface of the 12th free-ray are supplied by the nerve *S* (*ib.*, fig. 2). Each of the nerves to the spaces between the fin-rays divides equally into two; in the case of the nerve *S* the division is unequal. The nerve supply to the pectoral fin, described above, only refers to the seven ventral rays; no homologous nerve supply from the 3rd spinal nerve was found for the upper and lower surfaces of the 1st, 2nd, 3rd, and 4th, and upper surface of the 5th fin-rays. The fin- and free rays have a second and quite separate nervous supply, which arises from the united 1st and 2nd spinal nerves. In the case of the fin-rays, the latter is the larger nerve supply; in the case of the free-rays it is very insignificant, when compared with the nerve supply furnished by the 3rd spinal nerve. The main trunk of the united 1st and 2nd spinal nerves (*a*, fig. 1, Pl. XV.) runs down between the adductor muscle of the 1st fin-ray, and the scapula, and passes through the foramen in that bone, to the external surface of the arch (*a*, fig. 15, Pl. XIII.). On emerging from the foramen it divides into three branches, *x*, *n*, and *n'*. The nerves *n* and *n'* supply the abductor levator, and abductor depressor muscles respectively of the pectoral fin (fig. 19, Pl. XIV.). The main trunk, *x* (fig. 19, XV.), passes under the abductor depressor of the 1st fin-ray (*y*, *ib.*), and runs down through the bases of the fin- and free rays, between the two half-rays of each. It gives off a nerve twig to the upper and lower surfaces of each of the fin- and free rays. This nerve twig runs along with, and appears to unite with, the nerve twig furnished to the same surface of the fin-, or free ray, by the 3rd spinal nerve. The two nerve supplies of the lower three fin-rays are shown in fig. 4, Pl. XV.; the two nerve supplies of the 1st free-ray are shown in fig. 3, Pl. XIII. All the branches of the 3rd spinal nerve are sensory in function, with the exception of the branches *L* and *N* (figs. 3 and 8, Pl. XV.), which are motor nerves. Nerve *L* divides into three branches, *t*, *l*, and *o* (fig. 8, *ib.*). Nerve *t* goes to the anterior, and posterior adductor levator muscles of the 3rd free-ray (*ib.*). Nerve *l* supplies the deep adductor flexors of the 2nd, and 3rd free-rays (*or''* and *or'''*, fig. 23, Pl. XIV.), and passes through the foramen in the coracoid (*ib.*, and fig. 27, *ib.*) to be distributed to the

abductor depressor muscle of the free-rays (*dp'*, *dp''*, *dp'''*, fig. 19, Pl. XIV.). On leaving the foramen it passes outwards between the abductor depressor muscle of the 11th fin-ray and the corresponding muscle of the 1st free-ray (*ib.*). The inner adductor flexors of the 2nd and 3rd free-rays (*dr''*, and *dr'''*, fig. 24, Pl. XIV.) are supplied by the branch *o*. This nerve also gives a nerve twig to the spindle-shaped muscle which is inserted into the lower posterior corner of the 4th basal (*x*, figs. 23 and 24). The other branch of the 3rd spinal nerve, which is motor in function, *N*, is distributed along with the 4th spinal nerve to the muscles (*O*, *P*, *Q*, fig. 3, Pl. XV.), on the interior and superior surface of the pelvic arch. An enlarged drawing of the nerves to the pelvic arch is given in fig. 25, Pl. XIV. All the muscles of the pectoral arch, with the exception of those mentioned above, receive their nerve supply from the 1st and 2nd spinal nerves. The branch *b* from these two nerves supplies the anterior, and posterior adductor levators of the 1st and 2nd free-rays (*r'* and *r''*, fig. 11, Pl. XV.). The inner adductor flexor of the 1st free-ray (*dr'*, fig. 24, Pl. XIV.) also, is supplied by the nerve *b* (*ib.*, and figs. 9 and 11, Pl. XV.). The branch *c* supplies the anterior and posterior adductor levator (*pr*, *ib.*), and adductor muscles of the fin-rays (*pdr*, figs. 11 and 9, *ib.*). The deep adductor flexor of the 1st free-ray probably receives its nerve supply from branch *b*. A small nerve twig from branch *b* appears to pass down through the inner adductor flexor of the 1st free-ray (*dr'*, fig. 24, Pl. XIV.), to the deep adductor flexor of that ray (*or'* fig. 23, Pl. XIV.). The abductor muscles of the fin- and free-rays, with the exception of the abductor depressor muscles of the free-rays (*dp'*, etc., fig. 19, Pl. XV.) which are supplied, by the branch *l* of the 3rd spinal nerve, receive their nerve supply from the 1st and 2nd spinal nerves. The nerve trunk, *a* (fig. 1, Pl. XV.), after passing through the foramen (*F*) in the scapula, gives off the two nerves *n* and *n'* (fig. 19, Pl. XIV.; fig. 13, Pl. XV.), which run between the two layers of abductor muscles. Nerve *n* supplies the layer of muscles lying above it, viz., the abductor levators of the fin- and free rays (*psp*, *sp'*, *sp''*, *sp'''*, and sp^{iv}, fig. 22, Pl. XIV., and fig. 13, Pl. XV.). Nerve *n'* supplies the layer of muscles lying below it, viz., the abductor depressor muscles of the fin-rays only. In contrast with the nerve supply to the pectoral arch of the cod, no branch from the 5th cranial nerve to the external muscles was found in this gurnard.

Microscopic Structure of the Free-Ray.

A large double nerve runs along the upper surface of the free-ray. A similar nerve is supplied to the lower surface. As this nerve proceeds to the tip of the ray, it divides up into a large number of small nerve bundles. The division does not take place at one point, but progressively along the ray (fig. 12, Pl. XV.). The portion coloured yellow represents the double nerve on one surface of the free-ray. A section of the ray close to the tip shows the following characters (fig. 9, Pl. IV.):—In the centre are the two half-rays (*b*, *ib.*). Almost all the space within the layer *bs* (the *corium*) is taken up with nerve bundles. These are collected in two main masses—one mass above the half-rays, the other below the same, (*n'*, etc.). Round the periphery of the central area, and just within the corium (*bs*), is a circle of small nerve bundles (*n*, *ib.*). The rest of the central area is filled up with connective tissue. The epidermis is very highly specialised. The cuticle (*ct*) is composed of small compressed cells. Within it is the main layer of the epidermis, the malpighian layer (*hy*, *ib.*). It is composed of columnar cells, packed closely together, in an arrangement somewhat similar to that of the cells of the retina. In the sections examined, these cells varied much in length, and were irregularly placed,

as is seen in the enlarged drawing of a portion of the epidermis (*hy*, fig. 12 *ib.*). That this irregular appearance may be due to the fact, that the sections have been slightly oblique, is possible. Nuclei were observed in some of the cells. This layer is evidently highly specialised, and is in close connection with the peripheral nerve bundles (*n*, *ib.*). Strands of tissue (*s*) are observed connecting the malpighian layer to the cuticle. A longitudinal section of the tip of the free-ray (fig. 11, *ib.*) presents, as regards the different layers, a similar appearance to the cross-section. The nerve bundles form a reticulum round the tip of the ray within the corium. They are thus in close proximity to the malpighian layer, which has undoubtedly a special sensory function.

Zinconi* gives a drawing of a transverse section of the free-ray of *Trigla hirundo*. This section has been made further back than the T.S. described above. The nerves are not subdivided to the same extent as in the latter. He also describes what he calls isolated elements, found in the epidermis of the free-ray. Harrison Allen† has described the microscopic structure of one of the free-rays of the sea-robin (*Primotus palmipes*). The structure of the free-ray in this form is very similar to that in the grey gurnard.

If we compare the T.S. of the pectoral fin-ray with the T.S. of the free-ray, we find in the former, structures similar to those found in the latter, but in a much less specialised form. Fig. 10, Pl. IV. represents a T.S. through the two tips of the 7th pectoral fin-ray of the left side. The cuticle (*ct*) is a very thin layer. Beneath it is the malpighian layer (*hy*), which is very much smaller than the same layer in the free-ray. The half-rays (*c*, *c'*, *c''*, *c'''*,) are, in comparison to the whole fin-ray, very much larger than those of the free-ray. A layer of pigment (*pg*) is present below the malpighian layer, on the anterior surface of the fin-ray. The epidermis is of normal thickness.

Most observers agree that the free-rays function as tactile organs, though several assert that they also aid locomotion. When, however, we consider the abundant nerve supply, and the remarkable structure of their tips, we are forced to conclude that, whatever mechanical uses they may be put to, the free-rays of gurnards are primarily extremely sensitive organs of touch.

I beg to acknowledge my indebtedness to Professor M'Intosh for much valuable assistance.

EXPLANATION OF SOME OF THE LETTERS USED.

ar, articular surface.
c,*c*,*c*,*c*, basal elements.
cb, cerebellum.
ce, cerebral hemisphere.
cl, clavicle.
co, coracoid.
cp, cartilaginous plate.
dp, abductor depressor muscle.
dr, inner abductor flexor muscle of free-ray.
F, foramen in scapula.
f, foramen in coracoid.
f', ,, ,, 1st basal.
i, internal surface of clavicle.
ir, posterior adductor levator muscle.
lr, anterior ,, ,,
opl, optic lobe.
or, deep adductor flexor muscle.
pcl, post-clavicle.
pdp, abductor depressor muscles of pectoral fin-rays.
pdr, adductor muscles of pectoral fin-rays.
pf, pectoral fin.
pir, posterior adductor levators of pectoral fin-rays.
plr, anterior adductor levators of pectoral fin-rays.
pr, in fig. 19, Pl. XIV., adductor levators of fin-rays.
psp, abductor levators of pectoral fin-rays.
s, scapula.
scl, supra-clavicle.
sp, abductor levator muscle.
x, muscle inserted into 4th basal.
y, abductor depressor muscle of 1st fin-ray.

* Observations on *Trigla hirundo* and other Fishes, 1876.
† *Proceed. Acad. Nat. Science, Philadelphia*, 1885, p. 377.

DESCRIPTION OF PLATES.

Plate XIII.

Fig. 1. Shows external surface of the pectoral arch.
Fig. 2. Ventral surface of 1st free-ray, left side, showing the insertions of the muscles.
Fig. 3. Dorsal surface of 1st free-ray, left side, showing the insertions of the muscles and also the nerve supply of the ray.
Fig. 4. Internal surface of the pectoral arch.
Fig. 5. Ventral surface of 2nd free-ray.
Fig. 6. Dorsal surface of 1st pectoral fin-ray.
Fig. 7. Skeleton of pectoral fin, left side, posterior surface.
Fig. 8. 6th pectoral fin-ray.
Fig. 9. 3rd free-ray.
Fig. 10. Shows adductor-levator (*ir.*) muscles of the fin- and free-rays.
Fig. 11. Shows the adductor muscles of the fin-rays (*pdr*, &c.).
Fig. 12. 11th pectoral fin-ray (*no*, notch ; *t*, ligament).
Fig. 13. Shows the different origins of the adductor muscle of the 11th fin-ray.
Fig. 14. Shows the adductor-levator muscles (*lr*, *ir*, &c.) of the free-rays and of some of the fin-rays.
Fig. 15. Shows the two origins (dr_1 and dr_2) of the adductor muscle of the 3rd fin-ray.
Fig. 16. Shows the anterior adductor-levator muscles of the three free-rays.
Fig. 17. Shows the anterior and posterior adductor-levators (lr_5 and ir_5, &c.) of the more dorsal fin-rays.

Plate XIV.

Fig. 18. Shows the abductor-depressor muscles of the fin- and free-rays, and the ligamentous fascia (*l*) connecting their tendons.
Fig. 19. Shows the abductor-depressor muscles of the fin- and free-rays, with their nerve supply.
Fig. 20. Shows the brain and swellings on the beginning of the spinal cord.
Fig. 21. Shows the tendon connecting the supra-clavicle to the junction of the 1st vertebra with the skull.
Fig. 22. Shows the adductor-levator muscles of the fin- and free-rays (*bv.* blood vessel).
Fig. 23. Shows the deep adductor-flexor muscles of the free-rays, with the nerve supply of the muscles of the 2nd and 3rd free-rays.
Fig. 24. Shows the inner adductor-flexor muscles of the free-rays, and their nerve supply.
Fig. 25. Enlarged drawing of the nerve supply to the muscles on the superior, and internal surface of the pelvic arch.
Fig. 26. Shows the branches of the 3rd spinal nerve, from below.
Fig. 27. Shows the nerve (*l*) which supplies the abductor-depressor muscles of the three free-rays.
Fig. 28. Shows the ventral branches of the hypoglossal, and 1st, 2nd, 3rd, and 4th spinal nerves.

Plate XV.

Fig. 1. Shows plexus formed by the 1st and 2nd spinal, and hypoglossal nerves
Fig. 2. Shows nerve supply to the dorsal surfaces of the free-rays.
Fig. 3. Shows branches of the first four spinal nerves.
Fig. 4. Shows double nerve supply of the three ventral fin-rays.
Fig. 5. Shows nerve supply to the ventral surfaces of the free-rays.
Fig. 6. Enlarged drawing of plexus formed by the hypoglossal, 1st, and 2nd spinal nerves, as seen from within the body cavity.
Fig. 7. Shows obverse of fig 6.
Fig. 8. Shows the nerve supply, from the 3rd spinal nerve, to the pectoral fin- and free-rays.
Fig. 9. Shows nerve supply to the adductor muscles of the fin-rays.
Fig. 10. Shows nerve plexus formed by two of the branches of the 3rd spinal nerve.
Fig. 11. Shows nerve supply of the adductor-levator muscles of the fin- and free-rays (*pr.* and r', r'', and r'''), and also the nerve supply of the adductor muscles of the fin-rays (*pdr*).
Fig. 12. Semi-diagrammatic representation of the division of the double nerve on one surface of the free-ray.
Fig. 13. Shows nerve supply of adductor-levator and adductor-depressor muscles of the fin- and free-rays.

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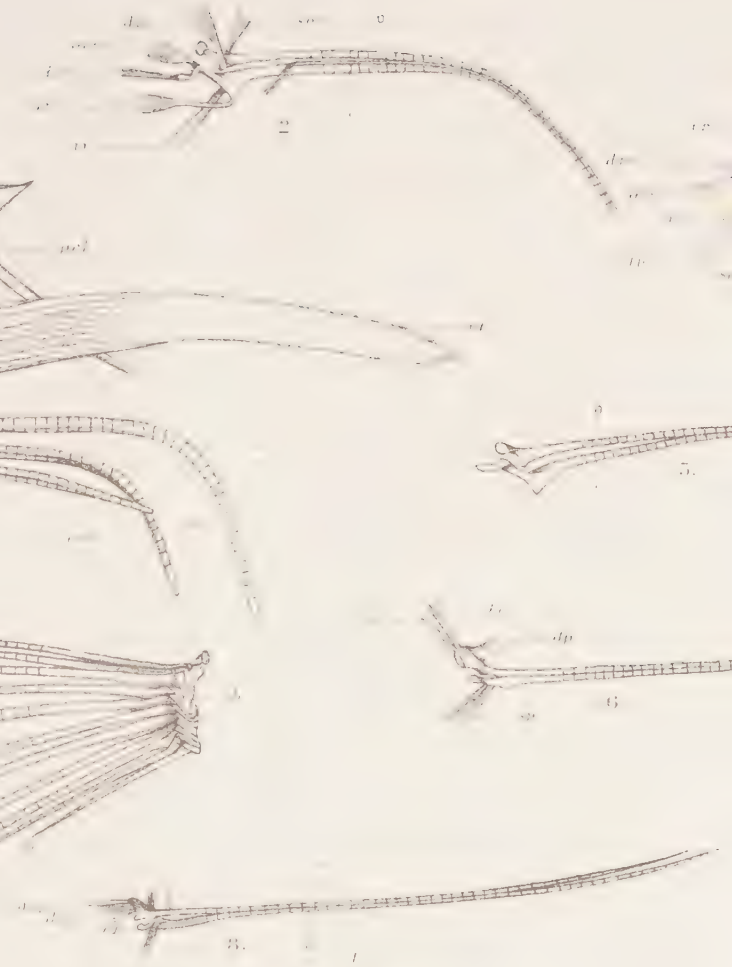

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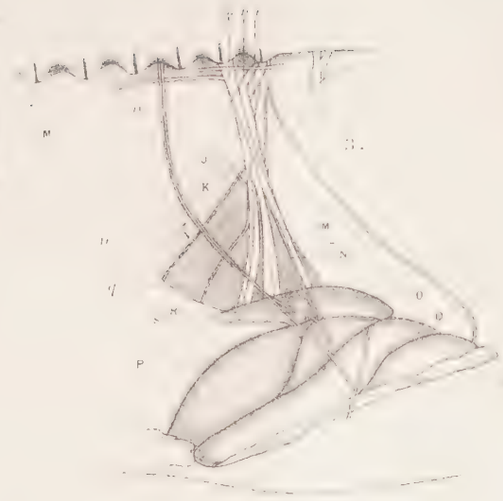
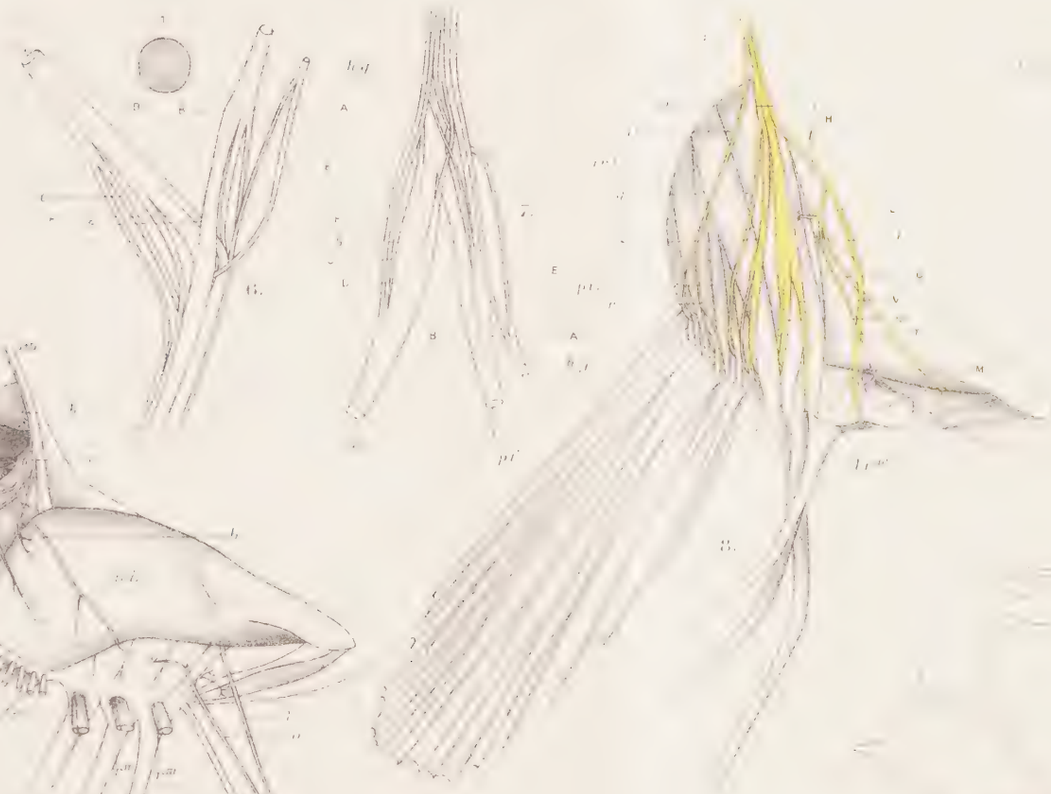
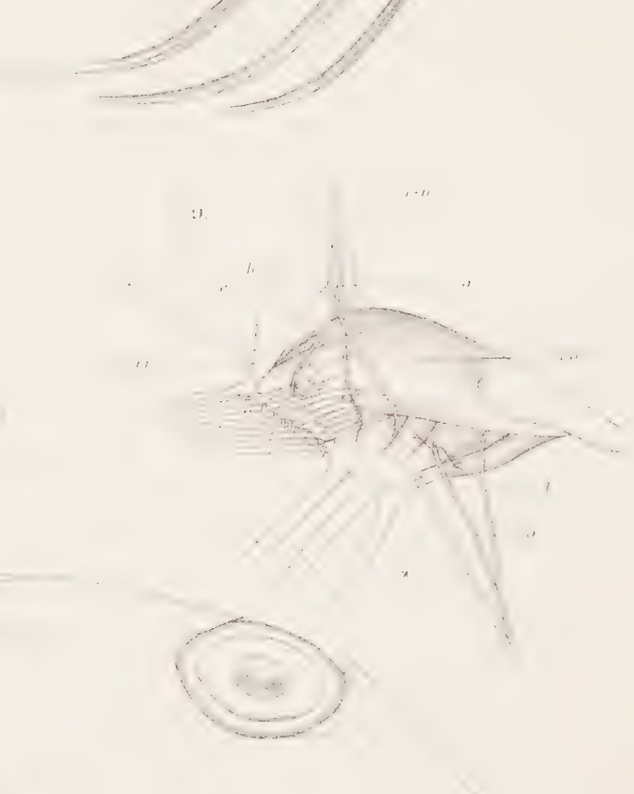
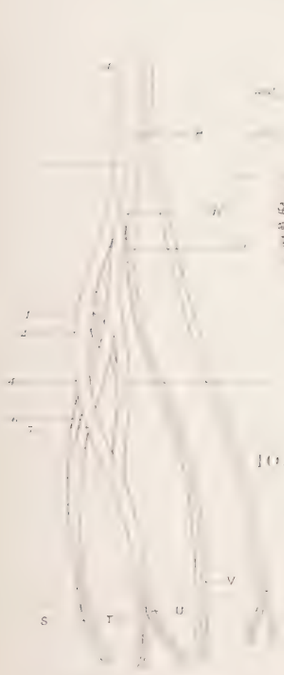
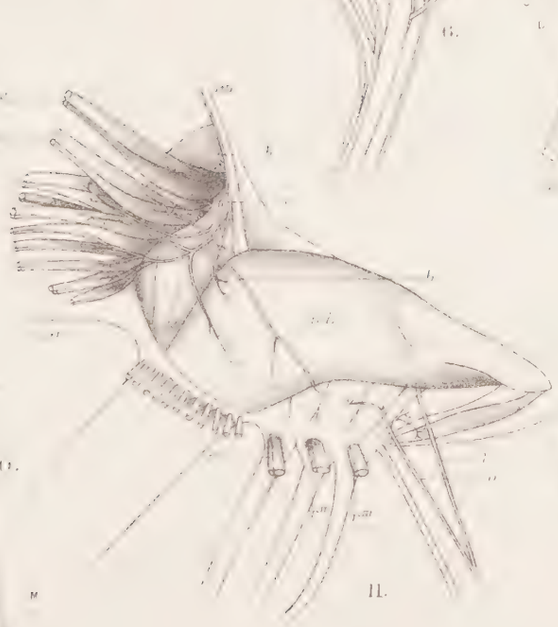
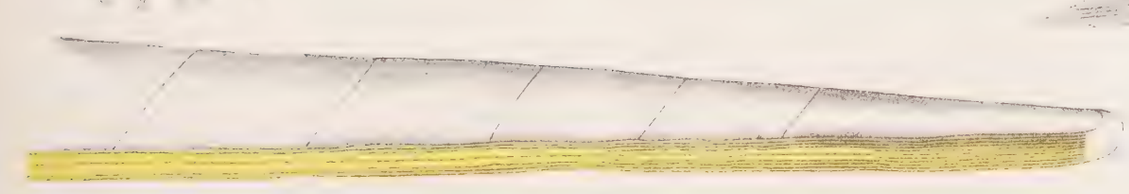












X.—ON THE RATE OF GROWTH OF CERTAIN MARINE FISHES.

By James R. Tosh, M.A., B.Sc., Fisheries' (Woodal) Prizeman, University of St Andrews.

1. Lumpsucker (*Cyclopterus lumpus*, L.).
2. Sea-Scorpion (*Cottus scorpius*, Cuv.).
3. Pogge (*Agonus cataphractus*, L.).
4. Diminutive Sucker (*Liparis Montagui*, Cuv.).

Cyclopterus lumpus, L. The Lumpsucker.

The lumpsucker spawns from the beginning of February to the end of May, or even later.* In the collection of preserved ova at the Marine Laboratory, St Andrews, is an instance of ova found as late as 12th July. This may be an extreme case. The specimens mentioned in the table fall into two series, the first hatched about the middle of May, the second somewhat earlier. The specimen of 1st June, at 53 mms., may be 1 year old, but is probably a little more.

Date of Capture.	No. of Specimens.	Length in Millimetres.	Calculated Age.	Probable Month of Spawning.	Place of Capture.
May 17, 1885	17	Average length 6	A few days	April	Tanks, Marine Laboratory.
„ 30, 1886	7	„ „ 6·75	13 days (known)	„	„ „
June 26, 1890	2	11 : 11	1 month	May	Jura, west, 20 fathoms.
July 3, 1893	7	11·5 to 13	1 to 1½ months	„	Salmon nets, St Andrews.
„ 8, 1886	2	11 : 12	1 „	„	Rock Pools, „
„ 25, 1884	2	14 : 16·5	2 „	„	E. Rocks.
Aug. 10, 1892	1	15	3 „	April	Bottom net.
„ 9, 1891	2	17·75 : 19	4 to 5 „	March	Salmon nets.
Apr. 28, 1884	1	25	9 to 10 „	June or July	E. Rocks.
June 1886	1	15	2 „	April	Bay.
July 8, 1886	1	16·25	3 „	March	Rock Pools.
„ 25, 1884	1	17	3½ „	„	E. Rocks.
Aug. 1865	1	18·5	4 „	„	Lochmaddy.
„ 22, 1887	1	22	5 „	„	E. Rocks, St Andrews.
„ 31, 1886	1	23	5 „	„	'Garland,' mid-water net, 18 fathoms.
June 1, 1887	1	53	1 year	May	Salmon net, St Andrews.

The fishes are very abundant on our coast, and when they come close inshore to spawn they are a great nuisance to the salmon fishermen. The well-known difference in size beween the males and the females may be looked on as an instance of the determination of sex by the rate of nutrition and growth. The same circumstance renders the predication of age after the first year a somewhat difficult problem. The males seldom exceed 15 or 16 inches in length, but the females commonly run to 20 or 21 inches, and rarely as much as 24.

Cottus scorpius, Cuv. Sea-Scorpion.

In the collection of ova of the father-lasher the specimens were found from 1st March to 30th May, but the adult specimens of February 1885 and January 1888, at 120 and 223 mms. respectively, were both females with distended ovaries, which would indicate a spawning time beginning early in February.

* M'Intosh and Prince, *Researches.*

Date of Capture.	No. of Specimens.	Length in Millimetres.	Calculated Age.	Probable Month of Spawning.	Place of Capture.
Mar. 25, 1890	1	5	Newly hatched	March	Tanks, Marine Laboratory
,, 31, 1888	20	6 to 7	8 days	,,	,, ,,
April 8, 1886	20	7 to 8·5	12 ,,	,,	,, ,,
,, 16, 1888	21	8·5 to 9·5	17 ,, (known)	,,	,, ,,
,, ,, 1892	3	9·25 : 10 : 10	20 ,,	,,	Forth, Station V., Bottom.
,, 29, 1890	2	9 : 9·5	16 or 17 days	,,	W. May Island, Surface.
May 10, 1885	1	13	1 month	,,	St Andrews Bay.
,, 19, 1890	1	17	1½ ,,	,,	Montrose, StationI., Bottom.
,, 27, 1890	1	20·5	2 ,,	,,	R. Eden.
June 22, 1886	2	20 : 21	2 ,,	April	E. Rocks, St Andrews.
,, — 1886	2	22 : 22·5	2½ ,,	March	Bay ,,
,, — 1887	2	24·5 : 25	2½ to 3 months	,,	E. Rocks ,,
July 26, 1884	2	35·5 : 38	4 ,,	,,	Pier Rocks ,,
,, — 1887	2	42 : 44·5	5 ,,	February	E. Rocks ,,
Sept. 11, 1889	1	54	5½ ,,	March	R. Eden.
,, ,, ,,	1	95	1 year + 3 months	May	R. Eden.
Feb. ,, 1885	1	120	1 ,, +11 ,,	March	St Andrews Bay.
Jan. 15, 1891	1	175	2 years+10 ,,	February	Forth, Station I.
Sept. 10, 1891	1	210	3 ,, + 6 ,,	,,	Moray Firth, Station III.
Jan. 1888	1	223	3 ,, +11 ,,	,,	,, ,,

Agonus cataphractus, L. The Armed Bullhead or Pogge.

The pogge spawns from January to April. The two specimens in the table, at 110 and 138 mms., were a male and a female, both nearly ripe. The spawning period of the pogge is subject to considerable variation. There are on record one or two cases of ripe pogges found at the end of summer.

Date of Capture.	No. of Specimens.	Length in Millimetres.	Calculated Age.	Probable Month of Spawning.	Place of Capture.
April 1, 1891	2	5	Newly hatched	March	St Andrews Bay. Tow-net.
,, 8, 1889	2	6 : 6·5	5 to 6 days	,,	,, ,, ,,
,, 22, 1889	6	7 to 8	10 ,,	,,	,, ,, ,,
May 9, 1889	1	8·5	15 ,,	April	,, ,, ,, Bottom.
,, ,, 1887	1	9	17 ,,	,,	,, ,, ,, ,,
July 4, 1887	1	17	3 months	March	,, ,, ,, ,,
,, — 1887	2	25 : 26	5 to 5½ months	January	Trawl, off Eden, St Andrews Bay.
,, 6, 1887	1	26			'Garland,' Forth.
Feb. 24, 1893	1	46	1 year	February	R. Eden.
May 27, 1890	2	51 : 56	1 ,, + 3 months	,,	St Andrews Bay.
July 1887	3	71 : 72·5 : 74	1 ,, + 5 ,,	,,	Forth, Station IX.
Sept. 12, 1892	2	87	1 ,, + 7 ,,	January	R. Tay.
Dec. 16, 1885	1	110	1 ,, + 10½ ,,	,,	,,
,, ,, 1885	1	138	2 ,, + 8 ,,	March	'Garland,' Forth, Station X.
Feb. 5, 1892	1	144	2 ,, + 10 ,,	,,	

Liparis Montagui, Cuv. The Diminutive Sucker.

The diminutive sucker generally spawns from the end of February to May. Of the adults the females are larger than the males, and are more frequently caught. The specimens mentioned in the last two entries in the table were all ripe females. Doubtless they were bearing eggs for the first time.

Date of Capture.	No. of Specimens.	Length in Milli-metres.	Calculated Age.	Probable Month of Spawning.	Place of Capture.
Mar. 11, 1887	2	5	Newly hatched	February	Tanks, Marine Laboratory.
„ 14, 1885	1	6	3 days	„	„ „
Apr. „ 1885	1	6·5	4 „	March	St Andrews Bay.
„ 16, 1892	1	7	6 „	„	'Garland,' Forth, Station V., Bottom.
May 16, 1892	1	11	About 20 days	April	„ „ Cross Sec. III., „
„ 20, 1894	1	13	„ 1 month	March	Off Aberdeen.
Aug., 1884	1	18	1½ months	May (end of)	St Andrews Bay.
Dec. 5, 1884	1	40	9 „	February	„ „
Mar. 4, 1885	2	71 : 79	1 year + 10 months	April	„ „
„ 18, 1885	2	81 : 79			

The ova of all the fishes treated of are demersal and adhesive. Those of the lumpsucker and the father-lasher are found in masses of several hundreds; those of the pogge and the diminutive sucker are usually in smaller masses sticking on hydroids and marine algæ. In reckoning the probable ages and time when spawned I have allowed 21 days for hatching, but the time taken in any given case varies with the temperature of the water, &c. The sea-scorpion, the pogge and the diminutive sucker are in all probability sexually mature by the end of their second year.

SECTION C.

PHYSICAL OBSERVATIONS.

REPORT ON PHYSICAL INVESTIGATIONS CARRIED OUT ON BOARD H.M.S. 'JACKAL,' 1893–94. By H. N. Dickson, F.R.S.E., F.R.G.S. (Plates XVI.–XIX.).

When requested by the Fishery Board to undertake the direction of physical work on board H.M.S. 'Jackal' during a month's cruise in August 1893, I was instructed to make a survey along the northern and north-western edges of the continental shelf, with the double object of extending and completing the work done by Dr H. R. Mill to the west of Lewis during July and August 1887, and of taking part in the international survey of the North Sea, which was at that time being arranged, at the instance of the Swedish Government, by Professor Pettersson of Stockholm. After the conclusion of the August trip, the Board decided to continue their co-operation with the Swedish, German, Norwegian and Danish Governments in the subsequent cruises, which were fixed to take place on 15th November 1893, 1st February and 1st May 1894; and I was requested to carry out the second part of the work. As the investigation is practically one in its aims and in the methods employed, I have thought it best to combine the reports on both undertakings in a single paper, thereby avoiding much repetition.

Our work being to examine the channels connecting the North Sea with the Norwegian Sea and with the Atlantic—including the Faeröe-Shetland Channel—in order to ascertain the sources of the different waters flowing through them, and the manner of their passage at different times of the year, soundings were made in such positions as would admit of the largest number of combinations into profiles or vertical sections, one series radiating outwards from the North Sea itself to the deeper water beyond the plateau, and another perpendicular to these radii, cutting through the face, as it were, of whatever currents might be flowing along the planes of the first series. At the head of Table I., the sounding stations are denoted by Roman numerals, and their latitudes and longitudes are given immediately below (see Chart, Plate XVI.). Stations I. to XXIX. were visited during the August cruise, which extended over nearly a month. It was originally intended to carry a line of soundings round the west of the Orkneys and as far down as the Butt of Lewis, in order to complete the connection with Dr Mill's previous work, but we were detained at Kirkwall by bad weather from 18th to 23rd August, and this extension had to be abandoned.

The time of the three later trips was limited to a week or ten days each, and an attempt was made each time to repeat the soundings at stations east of the Orkneys and Shetlands only. In November, observations were successfully made at Stations IX., III., IV. and VI. When Station VII. was reached, the great storm of November 16th to 20th was already making itself felt to such an extent that it was not possible to work more than 30 fathoms (55 metres) of line, and after that all work had to be abandoned. In February, it was hoped that, by working seawards instead of proceeding first to the most distant Stations and

working homewards, more might be accomplished, but we were only able to sound at Station XXVIII. and reach Kirkwall, where we were detained for five days. As the time at our disposal was then nearly exhausted, and it was still hopeless to work in the open sea, soundings were made at Station XXVI. and at new and more sheltered positions, XXX., XXXI., XXXII., XXXIII., in the Moray Firth, which may prove interesting in relation to previous work done by Dr Mill and Dr Gibson in that region. During the May trip the weather was much more favourable, and good soundings were obtained at Stations I., II., IV., VI., VII., VIII., IX., XXI., XXII. and XXIII. While sounding at Station XXIII. an extremely interesting observation of Clouston's "pocky" cloud was made (described in *Nature*, vol. l. p. 79), and its value as a storm-prognostic was unfortunately confirmed shortly afterwards.

The corrected positions of the Stations were reported to me in each case by the navigating lieutenant of the 'Jackal,' and although it is difficult to assign any mean error to the determinations, where these occur they must necessarily be small. Every care was taken, by working backwards from the first sight of land after each set of soundings as well as forwards from the departures before each, and by making astronomical observations whenever possible, to ensure the greatest possible accuracy. From the differences between the courses steered and the resulting positions, Lieut. N. Grant, who was navigating lieutenant of the 'Jackal' during the August cruise, made the important deduction that at every Station, from I. to XX. inclusive, the courses showed a southerly drift amounting to approximately 10 miles in 24 hours. The interruptions occasioned by the severity of the weather made it impossible to draw any general conclusions of this kind during the other trips.

Until the simultaneous observations of the other vessels engaged in the survey are all published, it does not seem advisable to attempt a full discussion of the observations we were able to make. This can be done much more completely when the combined data afford, as it is expected they will do, synoptic charts of the whole of the North Sea and the surrounding areas at four terminal dates during the year. In order that such charts may be drawn, it is the more necessary to make the work of each observer comparable with that of the others, and to describe in some detail the various methods employed. At the same time, our observations strongly suggest what may be taken as a working hypothesis, explaining the somewhat complex results obtained in an abnormal season like that of 1893, and indicating the lines along which future research must be prosecuted.

Equipment—General Arrangements for Sounding.

As has already been stated by other investigators, H.M.S. 'Jackal' is somewhat unfitted for the purposes of scientific research, chiefly on account of the impossibility of heaving her to. When her engines are stopped she immediately slews round broadside on to wind and sea, and hence, although soundings can be taken in a heavy swell, a moderately strong wind makes the ship drift so rapidly that an "up-and-down cast" of the lead becomes impracticable, and persistent attempts only lead to uncertainty about her position. Had it been possible to work the ship up to the lead in the usual manner, the interruption in the November cruise might not have taken place so soon, and the depths in some of the other soundings would have been less uncertain.

The sounding line employed consisted of 420 fathoms of 1-inch hemp rope. This was marked with red and blue worsted at intervals of

5 fathoms. Fresh measurements were made at intervals of a few days, when the line was examined and tested throughout. The line passed through an iron block hung from the guy of the cutter's after davit, close to the starboard gangway, and was led forward to the steam winch in the bows. Two leads lashed together, and having a total weight of 52 lbs. (23·6 kilogrammes), were used, and were found to be quite heavy enough for finding bottom at depths up to 200 fathoms. Both leads were freshly armed at every sounding, and during the May cruise samples of the bottom were preserved. These were submitted to Dr John Murray for examination.

Where the configuration of the bottom is very irregular, as is the case at most of the stations visited, it is difficult to assign a definite amount as the probable error of depth in making soundings. Check soundings were in every case made with a Thomson sounder, which, however, only carried tubes recording to 100 fathoms (183 metres), depths greater than this being merely recorded from the dial. On several occasions both methods gave the same result twice, the sounder differing from the lead by as much as 5 or 6 fathoms. We may conclude that the depths were in these cases really different, but the concordance or otherwise of the two readings (both given in Table I.) may, as a rule, be taken as a rough measure of the conditions under which each sounding was made,—the rougher the weather and sea the greater the excess found by the lead over that obtained with the sounder. In any case, it is certain that errors in measurement of depth cannot introduce much error anywhere else, for it will be seen that the variations in all the physical factors take place very slowly near the bottom. Down to 40 fathoms (73 metres) from the surface a near approach to accuracy can be obtained by frequent repetition, and in rough weather controlling observations were always made with a light hand-line carrying a 7 lb. (3·2 kilogrammes) lead, which could be used quickly when the heavier line paid out obliquely with the ship's drift.

It is matter of great regret that the bad fortune of one of the severest winters on record should have reduced the November cruise to two or three soundings, chiefly valuable in their bearing on the work of other ships which did not encounter the full force of the great storm of November 16th to 20th, and in February have prevented our getting near the proper ground at all. The August and May observations seem to afford a fairly complete view of the area surveyed, and I may be allowed to express my sense of the unfailing interest and energy of the commander and officers of the 'Jackal,' and of the intelligence and smartness of the men directly concerned in the work of sounding. My special thanks for personal assistance are due to Mr T. Mortimore, chief writer, whose long experience as an observer, and whose zeal, even when physically almost unfitted for duty by illness, alone made it possible for me to carry out so much of the work.

Temperature Observations.

These were invariably made with Negretti and Zambra's reversing thermometers, mounted in the Scottish frame. The corrections were carefully determined at the beginning and end of the August cruise, and the perfect agreement of the results under all the varying conditions made it seem superfluous to make further comparisons. Observations were made throughout at alternate depths in successive soundings, *i.e.*, if the depth were 100 fathoms, thermometers would be sent first to bottom, 80 fathoms, 60 fathoms, 40 fathoms and so on, and then at the next dip to 90

fathoms, 70 fathoms, 50 fathoms. By this method the risk of error, both in the depths and in the thermometer readings, was greatly reduced. In a few cases, especially in rough weather, the readings in one or two soundings appeared very erratic, but by continued repetition consistent results were always obtained, and, as a general rule, the working of the different thermometers left nothing to be desired. The lowest or "bottom" thermometer was attached to the line above the water-bottle at a distance of 9 feet (2·7 metres) from the extreme end of the lead. As it seems unnecessary to consider half-fathoms, a correction of 1 fathom (1·8 metres) only has been allowed in each case. Table I., the various head-lines of which explain themselves, gives the depths at which temperature observations were actually made, the readings of the Fahrenheit scales being corrected for instrumental error only. The temperatures were afterwards reduced to Centigrade scale, and plotted; Table II. gives the temperatures at uniform depths obtained by drawing freehand curves through the observed points. In addition to the column of fathoms, the depths are also given in metres to facilitate comparison with the work of the other vessels. A general table for converting fathoms to metres is also appended (Table XIII.).

Observations of surface temperature were made by collecting samples of water in a large canvas bucket, and immediately observing the temperature with an ordinary thermometer. During the August cruise it was found impossible to undertake a special series of surface observations, but the shorter periods over which the later cruises extended, and the enforced leisure in the unfortunate absence of soundings, enabled me to make extra observations with considerable regularity. These will be found in Table III. In very stormy weather it was deemed advisable to discontinue them, as the manipulation of the bucket while the ship was under way was not unattended with danger.

Collection of Samples and Determination of Density.

Mill's self-locking slip water-bottle was the pattern used for collecting samples. The working of this instrument left nothing to be desired so long as the sea was calm, but in rough weather there seemed to be some uncertainty in its action, as the spring detents were released and the bottle closed simply through the jerking of the sounding line caused by the motion of the ship. Every care was taken to reject doubtful samples, and to obtain duplicates where possible. Notes as to these will be found in the remarks in Appendix I.

With the view of avoiding these uncertainties I was led to devise a form of bottle which is let down closed and opened for the admission of water at the desired depth. A small model of this instrument (described at a meeting of the Royal Society of Edinburgh on 21st May 1894) was tried under very unfavourable conditions during the May cruise, and found to work satisfactorily.

Additional surface samples were preserved from the water brought up by the canvas bucket. These are indicated in the second last column of Table III. by numbers greater than 500.

The salinity of sea-water, usually expressed as total weight (grammes) of salts in 1000 grammes of water, is directly determined by weighing the evaporated residue from a known weight of the water. But this process, uncertain at its best, is inapplicable where large numbers of samples have to be dealt with, and recourse must be had to indirect methods, of which the two most important are based on estimations of

the amount of the total halogen (calculated as chlorine) contained by a sample, or on determinations of its density.

Until quite recently, it was believed that the salinity could be obtained at once when χ, the number of grammes of chlorine per kilogramme, was known by multiplying the latter by a constant factor, the value of which was variously given by Forchhammer at 1·811, Ekman 1·811, Tornöe 1·809, Dittmar 1·8044, and Jacobsen at 1·8094. From an examination of Ekman's results, however, Pettersson found that this chlorine factor, usually denoted by the Greek letter κ, was not constant, but varied in a manner depending on the salinity.

I am indebted to Professor Pettersson for the data of Table VII., which he considers the most trustworthy. The column headed χ gives the amounts of chlorine in grammes per kilogramme, p the salinity as defined above, and κ the chlorine factor computed.

From these we obtain the relation

$$p = 1{\cdot}83\chi - 0{\cdot}0012\chi^2$$

agreeing fairly with that derived by Professor Krümmel from analyses by Forchhammer and Jacobsen,* viz.,—

$$p = 1{\cdot}83\chi - 0{\cdot}0011\chi^2.$$

Hence
$$\kappa = p/\chi = 1{\cdot}83 - 0{\cdot}0012\chi.$$

The following table, based on this formula, may be useful:—

χ	p	κ	χ	p	κ
5·	9·120	1·824	14·	25·382	1·813
6·	10·938	1·823	15·	27·180	1·812
7·	12·754	1·822	16·	28·976	1·811
8·	14·560	1·820	17·	30·753	1·809
9·	16·371	1·819	18·	32·544	1·808
10·	18·180	1·818	19·	34·333	1·807
11·	19·976	1·816	20·	36·120	1·806
12·	21·780	1·815	21·	37·905	1·805
13·	23·582	1·814	22·	39·688	1·804

Applying this table to the data of Table VII., we get the differences between observed and computed salinities given in its last column, the mean of which is − 0·02. It must be borne in mind that we are here dealing exclusively with waters obtained from the North Atlantic, the Baltic, and their connecting channels; and that while these factors are probably fully applicable to the purposes of this paper, it does not follow that they are of universal application.

From Table XI. the salinity may be found by inspection for any value of χ between 17·50 and 20·59.

In calculating the salinity of sea-water from its density, the latter quantity must be multiplied by a factor which is constant provided the temperature of the fresh water to which the density of the sea-water is referred is the same as the standard temperature at which the density is recorded, but which is, of course, different for different standard temperatures. Instead of restricting ourselves to the limited number of samples of which a complete analysis and a trustworthy determination of density has been made, we may assume the substantial accuracy of the

* *Ergebnisse der Plankton Expedition*, Bd. I. C. p. 70.

values of κ given above, and calculate a factor σ_t from the known densities of samples and their salinities as obtained from the chlorines.

In selecting the particular value of t to be employed, it is sufficient that the temperature of 15° C., adopted by Professor Pettersson, is the one best suited to the purposes of these international observations, and at the same time nearest to 15°·56 C., that usually employed in this country although only saved from absurdity by its descent from 60° F.

Table VIII. shows the results of the analysis of sixteen samples, carried out with special care under Professor Pettersson's direction. Column 4 gives the chlorines of these samples, and column 5 the densities at 15° C. referred to that of fresh-water at the same temperature ($_{15}S_{15}$).* From column 4 we obtain the salinities in column 7, and dividing these by the densities in column 5 (*minus* 1000), we get the values of σ given in column 8, of which the mean is 1300, the maximum 1304, and the minimum 1295.

Taking the mean ratio of $(_{15}S_{15} - 1)$ and $(_{17\cdot5}S_{17\cdot5} - 1)$ as 1·0055, we get $1300 \times 1{\cdot}0055$, or 1307 as the value of σ when the temperature 17°·5 C. is used as a standard, slightly lower than that originally given by Karsten (1310).

For most practical purposes which cannot be served by salinities, it is more useful to refer the densities to that of fresh water at the temperature of its maximum density, 4° C. I have therefore thought it best to give the values $_4S_{15}$ instead of $_{15}S_{15}$, and in order to avoid the use of duplicate values a means of calculating the salinity p from $_4S_{15}$ must be found.

Starting with $p = 1300\ (_{15}S_{15} - 1)$ and noting that $_4S_{15} = 0{\cdot}99916\ _{15}S_{15}$ we have $p = \frac{1300}{0{\cdot}99916}\ (_4S_{15} - 0{\cdot}99916) = 1301\ (_4S_{15} - 0{\cdot}99916)$. To retain the simple form of the original expression we must equate this last to another containing the new factor s, then

$$s\ (_4S_{15} - 1) = 1301\ (_4S_{15} - 0{\cdot}99916),$$

and we get the following table:—

$(_4S_{15} - 1)$	s	$(_4S_{15} - 1)$	s
·009	1423	·019	1359
·010	1410	·020	1356
·011	1400	·021	1353
·012	1392	·022	1351
·013	1385	·023	1349
·014	1379	·024	1347
·015	1374	·025	1345
·016	1369	·026	1343
·017	1365	·027	1341
·018	1362	·028	1340

Table XII. gives the salinities calculated for values of $_4S_{15}$ between 1·02450 and 1·02659 by the above factors. In column 9 of Table VIII. will be found the values s, calculated directly from columns 6 and 7, and in column 10 the values of s obtained from the formula.

When work was first started in August last, I had no immediate prospect of being able to carry out any examination of the samples collected beyond the determination of their densities by means of hydrometers. From previous experience of these instruments, I believed that they could be made to yield results very fairly comparable amongst themselves,

* In the tables the densities S are given diminished by unity and multiplied b 1000, according to the usual convenient custom.

but I was by no means certain that these would be comparable with determinations made with other instruments, or by other methods.* I accordingly kept a number of the August samples, carefully sealed, in the hope that I might subsequently subject them to further tests, and thereby ascertain what correction was to be applied to the hydrometer densities. Through the kindness of Dr John Murray and Mr Robert Irvine, these and all the samples obtained in the later trips have been examined by Mr W. S. Anderson, the accomplished chemist of the Scottish Marine Station, who has spared no pains in making very complete determinations of densities by Sprengel tubes, of chlorines, and also of alkalinities. Table VI. contains his report on samples from the stations, and needs little explanation. Column 1 gives the number of the sample, corresponding with Table IV.; column 2 the temperature at which the Sprengel determinations were made; column 3 the densities found; column 4 the chlorine in grammes per kilogramme; and column 5 the alkalinity, or carbonic acid, in milligrammes per kilogramme. This report had unfortunately to go to press before Mr Anderson was able to complete his laborious task, but it is hoped that the omissions in this table will be filled up in a note next year.

Mr Anderson's report on the extra surface samples is included in columns 2 and 3 of Table V., which will be referred to later.

Six selected samples were also sent to Professor Pettersson at Stockholm, and the chlorines of these waters were determined in his laboratory. The agreement of the two analyses show that the work of Mr Anderson is closely comparable with that of Professor Pettersson, and I hope to be able to show that where direct determinations are wanting we have ample data for controlling the hydrometer work, and bringing its errors within the physical requirements of the investigation. My best thanks are due to Dr Murray and Mr Irvine for help without which a great part of our work would have been lost, and to Mr Anderson for his prompt response to heavy and recurrent demands upon his time.

The densities of all the samples, except those collected in the latter part of the February cruise, and the extra surface samples, were determined on board ship with the hydrometers. Two instruments of the 'Challenger' type were used, and as a check upon these the August samples were tested with a set of Dr Küchler's Kiel hydrometers.

The constants of both the Challenger hydrometers were determined three separate times with the utmost care, and each time the results agreed with those previously obtained by Dr Mill so far as concerned the volume of the instruments and their expansibility. Mr Anderson has since verified, and found correct, the weights of the instruments and their brass weights.

The number of readings made from both instruments varied from four to six, at least two with each hydrometer. No perceptible difference between the densities obtained by the two instruments can be made out, the values for almost every sample being divided indifferently between them. In 232 separate readings the positive departures from the mean density amounted to 0·00280, and the negative to 0·00269, and the sum of the squares to 2117 units of the fifth place of decimals. Hence the probable error of any one reading is

$$= \pm 0{\cdot}6745\sqrt{\frac{2117}{231}}$$
$$= \pm 0{\cdot}0000205.$$

In Table IV. will be found a column headed 'Probable error × 100,'

* See *Scottish Geographical Magazine*, 1893, p. 17.

which contains the probable error of the determinations for each sample, calculated from the formula

$$x = 0{\cdot}6745\sqrt{\frac{N}{n(n-1)}}$$

where N = sum of squares of differences of each determination from the mean, n = the number of determinations.

This column gives, as the mean probable errors in units of the fifth place,

73 August	samples	= 1·067
10 November	„	= 1·440
3 February	„	= 1·553
23 May	„	= 1·613
109 in all		= 1·230

The superiority of the August determinations is undoubtedly due to the more uniform temperature at which the determinations were made, but the consistency of the readings amongst themselves is throughout greater than could have been expected.

The Kiel hydrometers gave results agreeing throughout to the 4th place with those of the others, but the instruments are not, of course, so delicate.

In reducing the densities ${}_4S_t$ from the temperature t (given in Table IV.), the figures of Table X. were used. These were obtained from the table given by Krümmel for use with the Kiel hydrometers.* It agrees fairly with Dittmar's tables in the 'Challenger' Reports, although differing somewhat from Schück's revision of existing data.†

Coming now to the comparison of the hydrometer densities with those deduced by other methods, Table IX. contains the results of Mr Anderson's examination of 12 August samples and 10 November samples extracted from his report, Table VI.

The densities of the former lot were determined at the freezing-point of fresh water by means of Sprengel tubes, and estimations of chlorine were made, first approximately by Mohr's method and then by the more refined Volhard-Dittmar method. The chlorines only of the November samples were determined, except samples 74 and 76, of which the densities were determined by Sprengel tubes at 15° C. Column 1 of Table IX. gives the numbers of the samples corresponding to those of Table IV., column 2 the Sprengel densities at 0° C., column 3 the densities ${}_4S_{15}$ derived from column 2, column 4 the ${}_4S_{15}$ obtained from hydrometer observations at temperatures t of column 5, reductions being in both cases effected by means of Table X. Column 6 shows the differences between the Sprengel and the hydrometer densities. Column 7 contains the chlorines as determined by Mr Anderson, and column 8 as determined by Professor Pettersson. Column 9 gives the salinities found from Mr Anderson's chlorines by means of Table XI., and column 10 the differences between these and the salinities given by Professor Pettersson. Columns 11 and 12 give the salinities, obtained with the help of Table XII., from Sprengel and hydrometer densities of columns 3 and 4 respectively. Taking the salinities obtained from the chlorines (col. 9) as standards, columns 13 and 14 give the differences between them and those in columns 11 and 12. The departures from the mean of each individual case in columns 6, 13, and 14, are to be found in columns 15, 16, and 17.

* Ueber den Gebrauch des Aräometers an Bord, *Annalen der Hydrographie*, 1890, Heft x.

† *Das Ausland*, Nos. 40 and 41, 1893.

Dealing first with the August samples, the mean of column 5 is 13°·62, and of column 6, −0·14, which signifies that at a mean temperature 13°·6 C the hydrometers agreed in giving results 0·14 too high. Further, it appears from column 15 that if we diminish the hydrometer densities by 0·14 the mean error of the hydrometers, supposing the Sprengel tube results to be correct, is ± 0·03. This correction has accordingly been applied to all the hydrometer values of $_4S_{15}$ for the August samples in Table IV. Again, if we take the salinities of column 9, derived from the chlorines, as standards, the salinities computed from the Sprengel densities differ from them in defect by, on an average, 0·056, as shown in column 13, and allowing for this we get from column 16 a mean inconsistency of ±0·03. Similarly, we get from column 17 a mean inconsistency between chlorine and hydrometer salinities of ±0·04. Hence, for these samples, the hydrometer results are scarcely inferior in their accordance with the chlorines to those of the Sprengel tubes, and, as these samples are selected from all the different lots collected during the August cruise, they may fairly be taken as representative of the hydrometer work during that time.

I have thought it unnecessary to include the results obtained from the Kiel hydrometers in the tables, as these instruments do not profess the same degree of delicacy. But it is an important fact that the average of their readings for the same twelve samples, when reduced to $_4S_{15}$ by Krümmel's tables,* differed in excess from the Sprengel tube values by 0·13, only 0·01 less than the 'Challenger' hydrometers.

In the lower part of Table IX. the analyses of ten November samples are treated in precisely the same way as that just given, except that the Sprengel tube values are, with two exceptions, absent. Column 14 gives a mean difference of salinity amounting to 0·20, and column 17 departures from this mean averaging ±0·03, so that the hydrometer inconsistency is reduced to exactly the same as that of the Sprengel tubes in the former case. The mean of column 5 is 4°·61 C., and that of column 14 corresponds to a mean for column 6 of −0·23. A correction of this amount has accordingly been applied to the November samples in Table IV.

The densities of the February samples were determined by hydrometer only in the cases of Nos. 83, 84, and 85. The corrected values of $_4S_{15}$, given in Table IV., are accordingly those obtained by Mr Anderson, and for the three samples named give a mean hydrometer correction amounting to −0·12, at a mean temperature *t* 8°·61 C.

In the case of the May samples the densities of Nos. 97 to 115 were determined at Lerwick, the mean temperature being 12°·16 C., with the exception of Nos. 102, 105, and 111, of which there was not sufficient for treatment with the hydrometers. Mr Anderson's Sprengel tube determinations of the densities of these samples, which will be found in Table VI., give a mean result differing in defect from the hydrometer values by 0·11, the mean uncertainty being as before ±0·03. Samples 116 to 123, the densities of which (excluding No. 117) were determined at Aberdeen, mean temperature *t* 9°·58 C., also give a difference of 0·11 and a mean uncertainty of ±0·03. A correction of −0·11 has therefore been applied in Table IV. It seems unnecessary to give the data in the detailed form of Table IX.

When working with a single 'Challenger' hydrometer at the Marine Biological Laboratory at Plymouth, I found a similar difference between the Sprengel tube determinations and those of the hydrometer, the latter giving values 0·12 *too low* at ordinary temperatures, but the defect

* *Loc. cit.*

apparently varying with the density. All the 'Jackal' determinations were made in the laboratory on board whilst the ship was lying in harbour. In the August, November, and February observations, the hydrometer jar stood on a board adjusted level on the table, so as to compensate for any list on the ship. The swinging of the vessel was never sufficient to be an inconvenience in making the readings, seldom enough to be noticeable. The May determinations were made on a swing tray, similar to that used by Mr Buchanan,* suspended from a hook in the roof by a strong elastic band. The hydrometer jars, of which two were used, one for samples 1 to 72 and a second for the remainder, were 72 mm. and 65 mm. in diameter respectively; and the usual depth of water in them was 240 mm. It is important to note that the constants of the hydrometers were determined by the same observer, with the same jars and under the same conditions.

It appears that the 'Challenger' hydrometers give values almost as consistent as do the Sprengel tubes, when the chlorine values are taken as standards, provided always we know the amount of a varying correction, due to a peculiarity in the manner of working the hydrometers, and also apparently changing with the density of the samples treated. Mr Anderson seems to have shown conclusively, in a paper recently read to the Royal Society of Edinburgh, that the error is due to imperfect mixing of the water in the hydrometer jar. Its amount will therefore depend on the surrounding conditions of temperature, and its constancy on the similarity of conditions and of procedure in making each set of observations. Mr Anderson's explanation, which fully satisfies all my results, is quite unexpected, and shows that with proper precautions the hydrometer retains its place as one of the best instruments for work at sea. In any case I hope I have been able to show that the hydrometer values given for these samples may be trusted to within the limits required of them for practical purposes.

In the seventh column of Table IV. the densities given ($_4S_{15}$) are invariably the corrected hydrometer values where hydrometer observations were made. When these are absent from the preceding column the numbers given are the Sprengel tube values of Table VI. The salinities in the ninth column are calculated either from the $_4S_{15}$ of the seventh by the use of Table XII., or, when that is wanting, from the chlorines of Table VI. by the use of Table XI. In the tenth column are given the temperatures (T) of the water at the place from which the samples were obtained (from Table II.), and in the last column the densities ($_4S_T$) *in situ*, calculated from the seventh (or, where that is wanting, indirectly through the chlorines) and tenth columns by Table X.

Table V. refers exclusively to the additional surface samples, none of which were treated with the hydrometers. The numbers of column 1 correspond to those of Table III. Column 2 gives the chlorine, column 3 the density ($_4S_{15}$) calculated from column 2, or, where that is available, obtained directly by Sprengel tube. Column 4 gives the salinity obtained from column 3, column 5 the temperature and column 6 the density *in situ*.

Extra Observations.

During the three later trips I had a number of exhausted tubes for gas analysis on board, kindly sent over by Professor Pettersson, by whom they have been introduced.† The unfavourable conditions under

* 'Challenger' Reports, 'Physics and Chemistry,' vol. i., pt. ii.

† Skageracks och Kattegats Hydrografi, *Kongl. Svenska Vetenskaps-Akademiens Handlingar*, bt. 24, No. 11, p. 14.

which we had to work made it difficult to fill and seal these tubes in a satisfactory manner, and the fact that they could not be filled directly from the collecting bottle may further diminish the value of the results obtained from the few tubes I was able to use. The tubes have been sent to Professor Pettersson, but it is impossible that his analyses should be completed in time for insertion here. It is hoped that they will be published, along with the remainder of Mr Anderson's work, in next year's Report.

In the last column of Table III. will be found some observations of the colour of the sea surface, made with a Forel's colour scale constructed for me by Mr A. Frazer. As this instrument has not yet found its way into use in this country, and affords valuable information with small expenditure of time, trouble, and skill, besides being cheap and not liable to get out of order, I give the specification from which Mr Frazer constructed it.

Two standard solutions, one blue and one yellow, are made up as follows:—

Blue solution—
Sulphate of copper, 1 gramme.
Ammonia (density ·96), 9 grammes.
Distilled water, 190 grammes.

Yellow solution—
Neutral chromate of potash, 1 gramme.
Distilled water, 199 grammes.

Eleven glass tubes, 10 mm. in diameter and 60 mm. long, are then filled with mixtures of these solutions in the following proportions by weight:—

Tube.	Blue solution.	Yellow solution.
1	100	0
2	98	2
3	95	5
4	91	9
5	86	14
6	80	20
7	73	27
8	65	35
9	56	44
10	46	54
11	35	65

and the ends closed with well-fitting corks sealed over with paraffin. They are then mounted in a wooden frame, parallel to each other like the rungs of a ladder, about half an inch apart. Light wooden covers can be attached by hooks to both sides of the frame, to protect the tubes when not in use.

In using the instrument, hold it up to the sea towards a direction as far away from the sun as possible, note the tube containing the fluid which most nearly matches the colour of the surface, and record its number.

My observations, so far as they go, show that in the neighbourhood of Buchan Ness the colour of the sea-surface averaged about 3·5 of the scale, corresponding to about 7 per cent. of yellow, and that it became bluer to northward and westward, the yellow decreasing to under 2, or 1 per cent., off the north of Unst. Further north, and eastward, in the region of Stations IV., VI., VII., the amount of yellow increased to nearly 3, or 5 per cent. It will be seen later that the bluest regions are those in which there are other reasons to believe that the surface water is

most largely derived from the Atlantic; and if, as seems in the highest degree probable, the area covered by Atlantic water varies from year to year, the colour scale affords a means of detecting changes in its distribution. Regular observations at selected stations would afford information of great interest, and could be made where there are no facilities for observations of temperature or density. Krümmel's observations during the Plankton expedition in the North Atlantic seem to place the Forel Xanthometer in the position of the rainband spectroscope of the oceanographer.*

Although no zoologist, I was induced, at the urgent request of Professor Pettersson, to make a few surface observations during the May cruise with the tow-net, subject to instructions from Dr Fulton. As the great object in physical work is to keep the ship absolutely at rest, and as the 'Jackal' is unable to steam less than 4 knots except with a heavy head sea, a speed fatal to most tow-nets, my observations are probably unsatisfactory. The results have, however, been submitted to Professor M'Intosh and Mr Scott, whose report appears in Appendix III. The samples of the bottom brought up by the lead have, as already stated, been submitted to Dr Murray, whose notes are given in Appendix II.

Charts and Sections.

In the charts and sections the temperature lines are continuous, and the lines of salinity broken, throughout. The chart in the upper left-hand corner of Pl. XVI. shows the positions of all the sounding stations; and the remaining sketch maps show horizontal sections, with the temperatures at 5, 15, 20, 30, 40, 50, and 100 fathoms (9, 27, 37, 55, 73, 91, and 183 metres), and the salinities at surface, and at bottom or 200 fathoms (366 metres), as obtained from the August observations, the only series sufficiently complete to make such representation possible.

Plates XVII., XVIII., and XIX. give vertical sections as follows:—

Section	I. Stations XV., XIV., XIII., and a mean of Stations XI. and XII., August.
,,	II. Stations XVI., XVII., XVIII., XIX., XX., XXI., August.
,,	III. Stations XVII., XIII., August.†
,,	IV. Stations XVIII., XII., XI., I., IV., August.
,,	V. Stations II., III., IV., VI., VII., August.
,,	VI. Stations VII., VIII., IX., August.
,,	VII. Stations X., I., II., August.
,,	VIII. Stations VIII., V., and a mean of III. and IV., August.
,,	IX. Stations XIII., XI., X., IX., August.
,,	X. Stations XVIII., XIX., XX., XXI., XXII., XXIII., August.
,,	XI. Stations XXV., XXIV., XXIII., August.
,,	XII. Stations XXIX., XXVIII., XXVII., XXIV., XXII., IX., III., August.
,,	XIII. Stations XXIX., XXVIII., XXVII., XXV., XXI., August.
,,	XIV. Stations XXIII., VIII., IV., August.
,,	Va. Stations III., IV., VI., and VII. to 30 fathoms, November.
,,	XIIa. Stations IX., III., November.

* *Loc. cit.*, p. 89.

† The numbers XIII. and XVII. have been inadvertently transposed in the Plate.

Section	Vb.	Stations II., IV., VI., VII., May.
„	VIb.	Stations VII., VIII., IX., May.
„	XIIb.	Stations XXII., IX., III., May.
„	XIVb.	Stations XXIII., VIII., IV., May.

The region more particularly investigated is that in which the water of the Atlantic, traversing the Faeröe-Shetland Channel, enters the North Sea. That Atlantic water does enter the North Sea between the Orkneys and Shetlands, and to the north of the latter group, has long been matter of common knowledge; but the various expeditions which have worked in the Faeröe-Shetland Channel—the birthplace of modern oceanographic work—and in the North Sea, have hitherto left a debatable area between them, and the exact relation of the results obtained in the two cases has remained somewhat obscure.

The year 1893 was exceptionally favourable for our purpose. To the west and south of Scotland, a prolonged season of high temperature and excessive insolation raised the surface temperature of the Atlantic above its average, and the same may be held true of the North Sea itself. Further north again, in the Shetlands and in the Faeröes, over the whole region where we worked, the season, although warmer than the average, was not remarkable for its high temperature so much as for the absence of strong winds. I was accordingly led to expect that the comparatively small differences upon which we had to rely in identifying different waters would be more strongly marked than usual, and our task rendered correspondingly easier, and also that local disturbances, due to surface currents produced by passing gales, would be less likely to distort the view of the general circulation.

At the same time, the very fact of exceptional conditions in our own particular province made it seem all the more necessary to invade the territory of other workers on both sides, in order to ascertain how far our observations could be directly compared with theirs. On the landward or North Sea side this was the less necessary, as simultaneous observations were being made on a scale which would obviate the need of direct comparisons with the work of the 'Pommerania,' * the 'Drache,' † or previous cruises of the 'Jackal.' ‡ On the other hand, it seemed absolutely essential, in the absence of a special survey of that region, that we should make sufficient observations in the Faeröe Channel to determine the initial condition of the Atlantic water entering the North Sea, and generally to establish relations with the work of the 'Lightning,' the 'Porcupine,' § the 'Knight-Errant,' ‖ the 'Triton,' ¶ and the great Norwegian expedition in the Norwegian Sea.**

Time did not, of course, permit of anything like a complete survey of the Channel down to the Wyville-Thomson ridge, and we had no appliances for sounding in deep water. We were, however, able to take serial temperature observations down to 400 fathoms, and to obtain one sample from that depth. As we had only one water-bottle on board, I did not care to risk it below 200 fathoms until satisfied that the sounding-line was to be trusted.

* *Jahresbericht der Commission zur wissenschaftlichen Untersuchung der deutschen Meere in Kiel*, 1872–73. Berlin, 1875.

† *Die Ergebnisse der Untersuchungsfahrten S. M. Knbt Drache in der Nordsee in den Sommern* 1881, 1882, und 1884. Berlin, 1886.

‡ *Fishery Board Reports*, Nos. VI. and VII.

§ *The Depths of the Sea*, C. Wyville Thomson.

‖ *Proc. Roy. Soc. Edin.*, vol. xi., p. 638.

¶ *Annalen der Hydrographie*, 1883, p. 612.

** North Atlantic Expedition: *The North Ocean; its depth, temperature, and circulation.* H. Mohn.

It should be said, at the outset, that all the charts and sections appended to this paper have been drawn solely from our own data, the lines of equal temperature and salinity are those which seem to me to give the fairest interpretation of our observations, without reference to or comparison with any previous work.

Dealing first, then, with the source whence the water entering the North Sea is derived, we find that in lat. 60° there is a maximum of salinity (over 35·3) in the centre of the Faeröe-Shetland Channel, alike at the surface and at 200 fathoms, identical with that given by Buchanan * and Krümmel † for the Atlantic south of the Wyville-Thomson ridge. At Station XVII., the sample from 400 fathoms gave a salinity of 35·06, agreeing with the bottom sample at the 'Porcupine's' Station 64 (35·01) and with Mohn's chart of bottom salinity for the North Atlantic east of Iceland, sufficiently well to show that at that depth the water is almost wholly derived from the latter region.

On comparing the temperature observations with Mohn's analysis of earlier work, we find some very striking differences. Station XVII. lies directly on Section II. of Mohn's memoir, which is founded on observations of the 'Porcupine' (Station 64), the 'Triton' (Stations 67 and 70), and the 'Knight-Errant' (Station 32), immediately over a bank which rises to 450 fathoms. Extracting temperatures every 50 fathoms from Mohn's isothermals at Station XVII.'s place on the section, and comparing them with our observations, we get:—

Depth.	Mohn's Section II.	J. XVII.
0	(9·3)	(12·4)
50	9·0	8·3
100	8·7	6·0
150	8·2	6·0
200	6·9	5·7
250	5·0	1·4
300	4·0	0·4
350	2·0	0·0
400	0·0	−0·4

Again, the 'Porcupine's' Station 64 lies within 10 miles of Section I. (Plate XVII.), and, comparing in the same way, we get:—

Depth.	P. 64.	J. Section I.
0	(9·8)	11·7
50	7·5	8·5
100	7·2	7·6
150	6·2	7·1
200	4·2	5·9
250	1·2	4·6
300	0·2	3·1
350	−0·3	1·7
400	−0·6	0·0

It appears from these comparisons, beyond all possible allowances for error, that Section III. (Pl. XVII.) differs greatly from Mohn's Section II. At Station XVII. low temperatures are met with much nearer the surface than before, while the converse happens at Station XIII.

From the nature of the case, we can hardly suppose that these differences are to any great extent the result of changes in the original motion of the cold under-current entering the Faeröe-Channel at its northern end. It may be well, however, to examine the bearing of the 'Jackal' observa-

* 'Challenger' Reports, 'Physics and Chemistry,' vol. i.
† Humboldt Expedition.

tions, so far as they go, upon the movements of the under layers of water. At a depth of 300 fathoms, communication between the Atlantic basin and the Norwegian Sea is cut off, and the southern coast line of the latter assumes a nearly semi-circular shape, with a deep gulf opening north of the Shetlands, and running in a south-westerly direction to the Wyville-Thomson ridge. The motion of the water in the Norwegian Sea is cyclonic, and there is consequently a south-easterly to easterly current along the continental coast.

Mohn, basing his arguments on the British observations already referred to, concludes that the cyclonic circulation is continued in the Faeröe gulf up to its head; that water passes along the north-western side, against the cyclonic gradient and nevertheless rising, turns at the Wyville-Thomson ridge, where, moving for a time against the gradient, it descends and then passes along the coast line or isobath, *down* the gradient and therefore ascending.* Now, apart from theoretical considerations, the observations supporting these conclusions, so far as I can learn from the memoir, are, First, the concavity of the isothermals below zero centigrade along a section (VI) from Thorshavn in Faeröe to Walls in Shetland. The apex of this concavity is found in each case from 'Porcupine' Station 64: the western branch depends on a bottom temperature—1°·0 C. in 317 fathoms at 'Porcupine' Station 63, and the eastern on a bottom temperature—1°·2 C. at 'Porcupine' Station 65. Second, a high temperature at considerable depths at the south-eastern angle of the Channel, close to the Wyville-Thomson ridge—depending on the only 'Knight-Errant' observation (Station 33) on that side of the ridge, which comes into the plane of the sections. Third, a comparison of 'Knight-Errant' Station 33 and 'Triton' Station 67 with 'Porcupine' Station 64.

Concerning depths below 400 fathoms, we are not, of course, in a position to speak, but down to that depth we have already seen that the temperatures at 'Porcupine' Station 64, which is the key to the whole position, are liable to great changes, and this, along with the observations at Station XVII., show further that the observations of the 'Porcupine,' the 'Knight-Errant,' and the 'Triton' are not comparable. The 'Jackal' observations do not include a sounding close enough to 'Porcupine' Station 63, to enable us to confirm or contradict the western branch of the concavity in the isotherms. Station XIV. is, however, 18 miles west of 'Porcupine' 64, and, along with XIII., it would seem (Section I., Pl. XVII.) to indicate that the isotherms between 300 and 400 fathoms are nearly straight, but lower down on the west side than on the east. So far this result would show that the cold water does not flow over the Faeröe Bank, but moves along the western side of the Channel against the cyclonic gradient, at the same time sinking as much as the configuration of the bottom will permit. We have, however, a difficulty on reaching the Wyville-Thomson ridge, for, if the approach of the cold water to the surface on the western side, which depends on 'Triton' observations alone (Stations 64 and 98) is permanent, the water cannot be descending. The descent of the cold water at 'Knight-Errant' Station 33, of course, involves the permanence of the temperature maximum at that point, but the inclination of the 'Jackal' isotherms (Section I.) would favour the existence of a return current, the cold water being higher on the eastern side going *down* the gradient than on the western going against it, provided the difference of level increased, *i.e.*, that the cold water continued to rise as it moved towards the mouth of the Channel. That it does not rise, or at least was not doing so when our observations were made, is at once obvious from Section III.

A simpler explanation seems to satisfy our observations, and to find no objections in those previously made.

* *Loc. cit.*, p. 181, pl. xliv.

Granting the cyclonic circulation in the Norwegian Sea, the water moving round its southern half is deflected to the right on reaching the opening to the Faeröe Channel, and follows a south-easterly course, as little against the cyclonic gradient as possible. On the other side of the opening it strikes the edge of the continent almost at right angles, and divides into two, one branch flowing along the Faeröe Channel, and the other pursuing its course along the side of the North Sea bank. The direct impact alone would tend to make it bank up against the land; and the water above it, being warmer than the upper layers away from the land, would increase the effect. We have thus a single cold current flowing towards the Wyville-Thomson ridge occupying the whole breadth of the channel, and with its surface higher on the east side than on the west. As this current moves onwards, it tends to be deflected to the right by the earth's rotation, and its surface becomes level from east to west. Longitudinally, it follows the configuration of the bottom, and is finally arrested by the Wyville-Thomson ridge.

To account for the further progress of the water of this current, which seems to accord with observations down to 400 fathoms, whatever the circulation at greater depths, it is necessary to discuss the position of the stream flowing from the Atlantic over the Wyville-Thomson ridge. A warm drift current of water, whose salinity is greater than that of the Norwegian Sea, sweeps over the ridge with a velocity of at least 5 miles in twenty-four hours,* even apart from the tidal streams which are known to extend down to its summit. This current is not, in the first place, due to local surface winds, but is a part of the great westerly drift of the Atlantic, and may therefore be expected to increase in volume and velocity with an increase of force of westerly winds in that ocean. Again, the surface water of the Atlantic is much warmer than that of the Norwegian Sea, and therefore lighter. The surface is accordingly relatively higher, and the water tends to flow northwards and downwards. An excess of temperature above the average in the surface water of the Atlantic will increase the difference of level, and with it the volume and velocity of the outflowing current.

Passing the Wyville-Thomson ridge, the warm Atlantic water flows over the cold current from the Norwegian Sea, which has been stopped by the barrier, and is banked up against it. The relative lightness of the warm water offers a weaker resistance to the rising of the cold water forced up from below, and at the same time its rapid motion draws it away mechanically: the two waters become mixed at the level of the summit of the ridge, and move northward together. Obviously, the greater the relative lightness and velocity of the Atlantic current the greater the amount of cold water absorbed and carried away by the under-tow, and the more rapid the cooling of the upper current by mixture. But the Atlantic water, being salter than the other, sinks as it cools, and the faster it cools the more its downward motion is increased, and its horizontal motion diminished.

Hence, it appears that if from any cause the temperature or the velocity of the Atlantic current, or both, are increased, we have a kind of compensating arrangement whereby it is more rapidly cooled and its speed more rapidly checked, by the mixture with cold water from the under current. We note that the Atlantic current, moving northwards, is deflected to the right by the earth's rotation, and we should expect to find the cold current higher up on the western side of the channel just at the ridge, and the warm current lower down on the eastern side.

Now, during the winter 1892-93 the prolonged anticyclonic conditions over the British Isles kept the path of cyclones unusually far to the west,

* *See* Mohn, *loc. cit.*, p. 183.

therefore increasing the proportion of westerly and south-westerly winds near the Atlantic side of the ridge. And, as already explained, the excess of temperature during the spring and summer of 1893 was greater in the Atlantic than in the Faeröe-Shetland region. We have, accordingly, two conditions favourable to an increase of the Atlantic current over the ridge, apparently all that is required to account for the excess of cold water in the southern portion of the Faeröe Channel, and of warm in the more northern. The extraordinary access of warm Atlantic water may have kept the temperature of the water in the upper layers above the normal during the past winter, and, communicating its excess to the air, have assisted in bringing the unusually large number of cyclones so close to the land.

The longitudinal Sections III., IV., and the transverse Sections I., IX., VII., VIII., and V., show how the Atlantic water is gradually mixed with the mixture already occupying the region round the north-western and northern edges of the North Sea Bank, keeping to the right of the Faeröe-Shetland Channel, partly on account of the earth's rotation, but chiefly from the cause which ultimately becomes dominant, and deflects it round and over the northern end of the Bank—the general cyclonic circulation in the North Ocean.

Having accounted for the main source of Atlantic water in the North Sea, it is necessary, before inquiring how that water is distributed, to examine the conditions on the side opposite to that on which it enters. This can, of course, only be completely done by discussing the simultaneous observations made by other vessels, but the observations of the 'Jackal' supplied more information in this direction than we had any reason to expect. We may take it as a fact, not likely to be disturbed by further observation, that on the eastern side of the North Sea and along the Norwegian coast the general movement of the water is towards the north, and also that from the large admixture of river water its salinity is considerably reduced. Towards the end of winter and in early spring the supply of fresh water will be greatest, but its temperature will be very low, and hence, although its salinity may also be low, its specific gravity may be comparatively high. During summer, on the other hand, the supply of fresh water will be smaller, while its temperature will be high, and, although the salinity of the North Sea water may be relatively greater, its specific gravity will be low. We may thus have in summer warm salt water superposed on water cold and not so salt, both moving horizontally together, and the former protecting the latter from being warmed by the air. Suppose the side of such a stream to be separated by a partition from a mass of water of uniform salinity greater than that of either layer, but with a temperature gradient such that its upper part is heavier than the upper layer of the stream, and its lower part lighter than the under layer of the stream. If now the dividing partition be removed, the upper layer of the stream will tend to spread over the denser surface water, while the dense lower layer of the stream will bore its way under the lighter bottom water. Mixture will of course take place, the surface water of the stream will be cooled and made salter, the bottom water will be warmed and made salter, while the other mass will be warmed and diluted above, cooled and diluted below. On the surface the net result will be a fall of temperature and a gradual rise of specific gravity as we proceed outwards from the stream; at the bottom there will be a gradual rise of temperature and *a rise to a maximum specific gravity, succeeded by a fall*, the position of the axis of maximum being where the saltness of the one water and the coldness of the other combine in the proper relations.

It would seem that a process somewhat analogous to this occurs in the

North Sea. Station VII., situated at the extreme corner of the North Sea Bank, shows (Sections V. and VI) that it is within the region of Atlantic water, the cold under current suggesting itself near the bottom, but only in the temperature; on the surface the salinity falls to 33·7. [Working absolutely in the dark at the time I unfortunately did not take samples from intermediate depths, and the salinity lines in the sections involving this station, which merely represent the observations, are certainly wrong, the lighter dotted lines more probably representing the facts.] At Station VIII. (Sections VI. and VII.) the salinity shows that the water is almost wholly Atlantic, except at the surface, where it falls to 35·14, but the temperature shows great changes in the under layer, being 2° C. lower at 70 fathoms than was observed at Station V. At Stations XXI., XXIII., and XXIV., however, we get the remarkable distribution shown in Sections X., XI. and XII. From the surface down to nearly 20 fathoms the temperature rises as we go eastward, but below that depth a tongue of cold water appears, more and more sharply defined by greater differences of temperature at greater depths, the axis of greatest cold passing between Stations XXIII. and XXV. directly over Station XXIV., and thence apparently eastwards and north-eastwards, leaving Station VIII. considerably to the west.

The salinity, almost the same at surface and bottom in the neigbourhood of Stations XXII., XXIII., XXIV., diminishes from west to east at the surface, most rapidly in the north, but at the bottom the lines bend out on both sides of Station XXIII., where there is a minimum. As a result of the combined changes of temperature and salinity we get at the surface the line of specific gravity 1·0269. running almost north and south immediately to the east of the Shetlands, turning eastwards between Stations I. and II. Further east, the specific gravity becomes less, the fall being uniform near Stations XXII. and XXIII., but first slower and then more rapid further north. At the bottom, the line 1·0274, coming up from the Faeröe Channel, passes between Stations X. and XI., through I. up to III., and then sweeps southwards through IX. to XXV., whence it again turns south-eastwards nearly to XXVII. and round to north-east, west of XXIII. The line 1·0277 passes through VII., VIII., just east of XXIV., down to XXV., where it doubles back on itself, and passes considerably to the west of XXIII. Here then we have the axis of heaviest water, starting at Station XXIV., and running north-east, evidently well to the east of Station VII. At Station XXIV., however, this distribution is suddenly interrupted by the strong tidal currents between Shetland and the Fair Isle. Our knowledge of these currents from direct observations is, unfortunately, meagre. I extract the following from the *North Sea Pilot*.

Fair Isle.—'During springs its (the tidal stream) greatest rate is from '3 to 4 knots an hour; its direction during the flood is, for the first three 'hours, to the south-east, then south for two hours, where it gradually 'curves to the westward and northward, thus describing a long oval, and 'revolving in the direction of the hands of a watch.'

Foula.—'On the east side of Foula, and about the Hoevdi ground, 'the north-going stream commences at 1 h. and the south-going at 7 'h. full and change. The general direction of the stream is N. by W. 'and S. by E., and its strength in the offing does not exceed 2 knots.'

Sumburgh Head.. The Röst.—'At the beginning of the flood stream 'the Röst is off the head; it then gradually works to the south-eastward 'and southward, ceasing with the end of the flood stream, when 'the 'Still,' as it is termed by the natives, occurs. At the beginning of the 'ebb the Röst is more abreast of Horse Island, and gradually extends

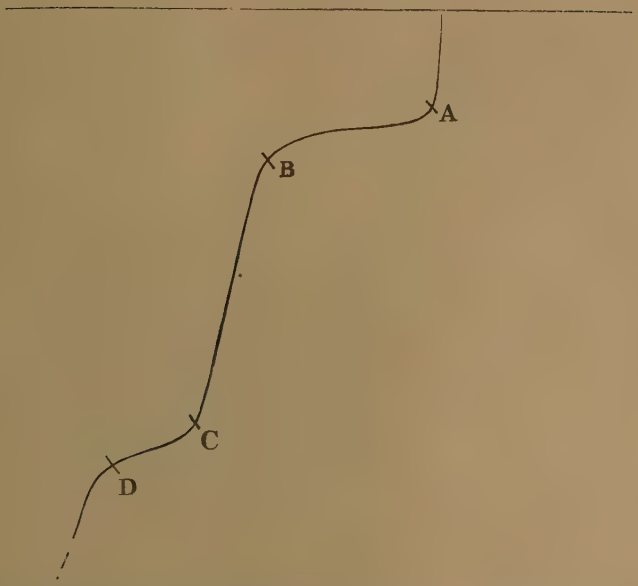
'from it, first to the south-west, and then to the westward and north-'ward, ceasing again with the low-water slack. . . . . .'

The Tidal Stream.—'Off Sumburgh Head the strength of the tidal 'stream at springs reaches 7 knots per hour, and at neaps 3½ knots. The 'change of stream, except close inshore, is at high and low water on the 'shore. . . . The direction of the flood stream is S. by E. for the first 'three hours, it then gradually trends S. and S.S.W. with high water, 'when its direction is westerly for a short time, and then north-westerly 'until low water.'*

The profound effect of these S.E. and N.W. streams is so strikingly exhibited by the maps and sections as scarcely to call for detailed description. At Stations XXV., XXI., XX., XII., XI., and, even at X., the lowering of temperature in the upper layers and the raising in the lower is easily recognised, and at Stations XX. and XXI. the mixing of the waters is so complete that temperature does not vary 0°·1 C. from surface to bottom in a depth of 50 fathoms. The result of this action is to produce off the south and south-west of the Shetlands a well-marked maximum of specific gravity at the surface, and a still stronger minimum at the bottom, and we accordingly have water of lower salinity drawn from the North Sea round to the north of the Orkneys, as far as Stations XIX. and XX., accompanied at the former station, where the tidal action is weaker, by a certain amount of up-welling, as shown by the cold patches on the maps for 20 and 30 fathoms.

Observing that the intense cold and moderate rainfall of the preceding winter, and the great heat and dryness of the summer of 1893, would tend to diminish all differences of salinity, and greatly to increase all differences of temperature in the two masses of water coming from the eastern side of the North Sea, we are able to trace the processes of mixture in some detail by means of the temperature charts and sections alone: temperature is, in this case, a more delicate guide than salinity whatever refinements be employed in the determination of the latter, because the variations of the former are considerable, while those of the latter are comparatively trifling—scarcely 4 per cent. at the utmost. Consider a vertical section at a point where warm and surface water flows over a body of what we assume to be Atlantic water, while at the same time cold bottom water is boring its way underneath. The normal temperature curve, shown in the figure, will then consist of:—First, a straight part, from the surface down to a point which we may call A, representing the surface flow; second, a bent part, in which the temperature falls more or less rapidly down to a point B, representing an intermediate layer, extending from the under limit of the surface flow to the upper limit of the 'Atlantic' water, in which the process of mixture is actually going on; third, a straight part, showing a slow fall of temperature down to C, the under limit of the 'Atlantic' water; fourth, another bent part C D, representing the layer where mixture of 'Atlantic' and bottom water principally takes place; and, fifth, a straight part extending to the bottom of the sea—the cold bottom water. The following Table shows the variations on this typical curve actually observed during the August trip. (See also Table II.)

* Cf. *The Tidal Streams of the North Sea*, by F. Howard Collins, 1894.



Station.	Depth of A.	Depth of B.	Thickness of A B.	Mean Fall of Temperature in A B per fathom.	Depth of C.	Thickness of B C.	Depth of D.	Thickness of C D.	Mean Fall of Temperature in C D per fathom.
I.	23	26	3	0·53	55	29	65	10	0·05
II.	14	22	8	0·15	.	.	.	.	.
III.	16	19	3	0·53	.	.	.	.	.
IV.	17	28	11	0·19	40	12	50	10	0·04
V.	20	34	14	0·18	80	46	90	10	0·06
VI.	18	22	4	0·40	.	.	.	.	.
VII.	15	21	6	0·35	172	151	183	11	0·11
VIII.	19	25	6	0·58	66	40	77	11	0·16
IX.	23	34	11	0·25	.	.	.	.	.
X.	15	32	17	0·15	.	.	.	.	.
XI.	10	23	13	0·15	.	.	.	.	.
XII.	.	.	.	.	.	.	.	.	.
XIII.	11	50	39	0·09	.	.	.	.	.
XIV.	28	35	7	0·23	160	125	195	35	0·05
XV.	16	30	14	0·07	48	18	93	25	0·06
XVI.	.	.	.	.	45	.	50	5	0·14
XVII.	.	.	.	.	190	.	265	75	0·07
XVIII.	20	40	20	0·14	.	.	.	.	.
XIX.	12	18	6	0·52	.	.	.	.	.
XX.	.	.	.	.	.	.	.	.	.
XXI.	.	.	.	.	.	.	.	.	.
XXII.	10	.	.	.	.	.	50	.	.
XXIII.	14	19	5	0·90	30	11	35	5	0·26
XXIV.	22	.	.	.	.	.	49	.	.
XXV.	0	15	15	0·10	45	30	49	4	0·32
XXVI.	15	20	5	0·14	.	.	.	.	.
XXVII.	.	.	.	.	20	20	.	.	.
XXVIII.	15	16	1	1·70	30	14	40	10	0·11
XXIX.	5	9	9	0·21	.	.	.	.	.

The first column gives the number of the Station, the second the depth (in fathoms) of the point A below the surface, the third the depth of B, the fourth the thickness of the stratum A B, the fifth the mean fall of temperature, per fathom, in A B. The sixth column gives the depth of C below the surface, the seventh the thickness of B C, the 'Atlantic' water, the eight the depth of D, the ninth the thickness of the layer of mixture C D, and the last the mean cooling per fathom in C D.

Now, returning to the supposed case of a partition with hot and cold layers on one side, and the 'Atlantic' water on the other, we note that when the partition is removed and the warm upper layer flows over the surface, the cold under layer at the same time moving along the bottom, the following changes in the form of the vertical temperature curve will take place progressively as we move away from the position of the partition towards the 'Atlantic' mass. First, the point A will approach nearer and nearer to the surface, ultimately reaching it. Second, the point D will approach the bottom, also ultimately reaching it. Third, the layer of 'Atlantic' water C D will increase in thickness. Fourth, as the horizontal differential motions diminish through the equalization of temperature, the tendency to vertical motion will increase through the equalization of density, and the thickness of the intermediate strata of mixture A B and C D will become greater; the temperature gradients within them at the same time becoming less steep.

Under this system, bearing in mind that outside the North Sea the 'bottom water' is that of the cold current from the Norwegian Sea, and the 'surface water' the warm Atlantic water which is still an integral part of the current in the Faeröe Channel—as distinguished from that which has been brought to rest by cooling and mixing, or to a uniform temperature and density by strong tidal action (either of these forms being what for our present purpose we call 'Atlantic,' *i.e.*, intermediate and inert, water)—we are able to classify the temperature curve of every sounding made during the August cruise. Stations I. and III. show A B at a depth of about 20 fathoms, thickness 3 fathoms, gradient 0°·5 per fathom. Stations II. and IV., somewhat to left and right of the main stream from the Channel, give A B at a depth of 15 fathoms, thickness 10 fathoms, gradient 0°·2 per fathom. The North Sea bottom water fails to reach II. and III., hence C and D are absent. C occurs at a depth of 55 fathoms at Station I., and 40 fathoms at Station IV.; C D is 10 fathoms thick in both cases, and the gradient 0°·05.

At Station V. the surface conditions are much as at II. and IV.; C occurs as low down as 80 fathoms. At VI. A B is 4 fathoms in thickness, gradient 0°·40, and the salinity observations confirm the view that the surface layer is now derived from the North Sea, not from the Faeröe Channel; the cooling and consequent descent of the Atlantic water in the lower layers has now so far progressed that C D is only indicated by a waviness in the curve at about 100 fathoms. At VII. A is 15 fathoms down, and A B 6 fathoms thick, gradient 0°·35. The bottom water at this station is derived from the Norwegian Sea, and C is reached at 172 fathoms, D at 183 fathoms. The conditions at all these positions are necessarily complex, owing to the varying angles at which the different currents meet one another. Taking next the western stations, we find the part C D only at XIV. and XVII., showing that except at these stations Atlantic water extended either to the bottom or below 400 fathoms. At XII., XX., and XXI., A and B are also absent, owing to the mixture by tidal action. Station X., to the right of the current, gives A at 15 fathoms, A B 17 fathoms thick, gradient 0°·15. Stations XI., XIII., XIV., show A B at various depths and thicknesses, the curve being distorted in some places, and its presence at all evidently due to the tidal suction towards the Station XII. region; possibly complicated by the strong tidal streams running east of the Faeröes. At XIV. C is found in 160 fathoms. At XIV. and XVII. A B is absent, these stations lying right in the main stream; at the latter, C occurs at 190 fathoms, D at 265 fathoms, showing a layer of mixture of Atlantic water with the under current 75 fathoms in thickness. At XVIII. A B is 20 fathoms in thickness, the surface layer, also 20 fathoms thick, being probably a mixture from the warm current, the

tidal stream, and the North Sea. At XIX. the surface layer is evidently largely drawn from the North Sea, and is being sucked into the tidal area.

On the eastern side the curves naturally adhere more closely to the typical form, especially at the stations nearest the sources of heat and cold. Station VIII. gives A at 19 fathoms, thickness of A B 6 fathoms, gradient 0°·58 ; C at 66 fathoms, B C 11 fathoms thick, gradient 0°·16. Station XXIII. gives A at 14 fathoms, thickness of A B 5 fathoms, gradient 0°·90; C at 30 fathoms, C D 5 fathoms thick, gradient 0°·26. Note that at VIII. B C is 40 fathoms thick, and the bottom layer 9 fathoms, while at XXIII. B C is only 11 fathoms, and the bottom layer 26 fathoms. At Station XXIV., on the axis of maximum specific gravity, A is 22 fathoms below the surface, and D 32 fathoms from the bottom, while B and C have run together, the whole intermediate space of 27 fathoms being a layer of mixture. At XXV., at the end of the great tidal stream, A is on the surface, *i.e.*, there is no layer in which active mixture is not going on ; B is 15 fathoms down, and the gradient 0°·10 ; the layer of bottom water is 17 fathoms thick ; C D 4 fathoms, gradient 0°·32.

At Stations XXVII., XXVIII., and XXIX., we come to the mixing at the *face* of the Atlantic stream entering the North Sea instead of at the sides, and, further, to an arrangement of water off the Scottish coast which must differ considerably from that on the other side. At XXVII. it would seem that a surface layer of Atlantic water extends down to 20 fathoms, and a layer of mixture, with the water already present, from there to the bottom. At XXVIII. the surface layer is reduced to 15 fathoms ; A B is only 1 fathom in thickness, with the extraordinary change of 1°·7 in temperature ; the intermediate layer of 'old water' (B C) is 14 fathoms thick, and below it the cold bottom water from the eastern side seems to re-appear, probably on account of the opening of the Moray Firth. At XXIX. the surface layer is further reduced to 5 fathoms, the layer of mixture with 'old water' increased to 9 fathoms, and the bottom layer is absent. Station XXVI. gives A at a depth of 15 fathoms, B at 20 fathoms, gradient 0°·14.

In discussing the mixture of different bodies of water it is scarcely possible to avoid dividing one from another with undue sharpness. The 'layers of mixture,' as A B and C D, at any point must be understood to mean only those layers in which mixture is actually going on at that point ; the 'surface layer,' or the 'Atlantic layer,' or the 'bottom layer' are not necessarily composed entirely of water derived from the original sources whence they are named, but may themselves be the results of mixture which has previously taken place. When differences of temperature alone are considered, it must be remembered that warm currents are derived from a body of water which has itself been warmed gradually, and that they must first warm by mixing the water which took their place in the colder seasons of the year. We have to deal with an area already occupied by a mass of water tending to become uniform in temperature and salinity, and can recognise the intrusion of masses of water only by elevations and depressions above or below the mean. Also it must be noted that local atmospheric influences will produce a change of temperature, which must, however, diminish continuously from the surface downwards, and cannot give rise to sudden variations.

Obviously the clearness with which the arrangement of strata appeared from the August observations was, in great part, due to the extremes of temperature experienced in the winter 1892–93 and in the summer of 1893, and above all to the absence of strong winds. The whole system is evidently largely dependent on changes of temperature, and liable at any time to suffer almost complete transformation by persistent winds of

even moderate force. That it is, however, to a certain extent permanent, especially in the lower layers, is distinctly shown by the observations of the 'Drache' and by the earlier work of the 'Jackal.'

As the season advances the warming of the North Sea water and the cooling of the Atlantic water will cause the axis of maximum specific gravity at the bottom to turn eastwards, probably diminishing the supply of the latter to the British side of the North Sea, and allowing it to cross more directly to the eastern side. Ultimately the axis will disappear altogether, but the increasing volume of North Sea water moving northwards will check the entrance of Atlantic water, except perhaps through a part of the Norwegian Channel. This is clearly shown by the few observations we were able to make in November. Temperature was practically uniform from surface to bottom at Stations IX. and IV.; at III. a slightly bending indicated a point C at a depth of 110 fathoms, and at VI. and VII. a point B appeared at 15 and 20 fathoms, respectively. The salinity was 35·2 at the surface at Station IX., and 34·6 at the bottom, the conditions of specific gravity indicating instability. The salinity at the bottom, Stations III. and IV., showed practically pure Atlantic water, but as far west as Station VI. the bottom salinity fell to 33·8—if, what is extremely doubtful, sample 80 is to be trusted. The presence of so fresh water at this station even at the surface, is, however, remarkable.

The May observations show, with unexpected clearness, the gradual development of the conditions observed during the previous August. The high surface salinity and the absence of the part A B in the temperature curves, as well as the specific gravity, indicate that North Sea water had not yet begun to flow outwards at the surface. At the bottom, although Atlantic water of salinity 35·4 has penetrated well to the east and north of the Shetlands, its temperature is not high enough and mixture with the North Sea water has not progressed sufficiently far, to reduce the specific gravity of the latter to a marked degree; and although the salinity falls faster than in August the greater weight and pressure are with the North Sea water, and the Atlantic water finding its way into the North Sea near the bottom is almost wholly that forced in by the tidal stream to the south of the Shetlands. It is to be observed, however, that at Stations I., II., VI., VII., and IX., the temperature curves indicate the warming of the supplies of Atlantic water, and at VIII. C D is already quite clearly marked.

To sum up, we may conclude that, while the Atlantic current flowing over the Wyville-Thomson ridge probably attains its maximum velocity during the cyclonic winds of winter, its speed is maintained in summer by the greater warmth of the upper strata in the Atlantic, and the consequent higher level of the surface, compared with the Norwegian Sea. When the temperature is above the average the current from this cause will be correspondingly increased.

Passing over the Wyville-Thomson ridge, the Atlantic current flows over the water of the cold under current from the Norwegian Sea banked up against the ridge, draws it up by a kind of under-tow, and is cooled by mixture with it. Owing to its greater saltness the Atlantic water when cooled sinks, losing its northward horizontal motion. The greater the speed of the Atlantic current and the lighter its water (*i.e.*, the greater the excess of temperature above the average) the stronger the under-tow at the ridge, the greater the demand for Arctic water (*i.e.*, the greater the relief of pressure at the mouth of the Faeröe-Shetland Channel) and the more rapid the mixture. Hence, in a hot windless summer, a mass of Atlantic water, extending to a great depth, tends to collect on the north-

western and northern edge of the North Sea Bank. During winter the Atlantic current is probably carried further north by the wind, and then deflected towards the Norwegian coast by the general cyclonic circulation of the Norwegian Sea, its relatively high temperature and low specific gravity keeping it on the outskirts of that system except at the surface, although not to the same extent as in summer, the difference of specific gravity being less.

At all seasons of the year Atlantic water is drawn from the Faeröe Channel current and forced into the North Sea by the tides between Orkney and Shetland. The tidal streams, however, run N.W. and S.E., and an eddy is formed to north-west of the Orkneys, between the stream and the Channel current, into which North Sea water is drawn, and perhaps also water from below.

In early spring North Sea water, cooled by land cold, increased in volume and lowered in salinity by the discharge of Continental rivers and the Baltic, fills the whole of the opening between Shetland and the Continent, blocking the entrance of Atlantic water, except possibly along the Norwegian coast. The specific gravity of this water is greater than that of the Atlantic current, on account of its low temperature, and Atlantic water gains entrance to the lower strata of the North Sea almost entirely by the tidal streams already mentioned.

As the season advances the surface water of the North Sea becomes warmer, the upper layers probably receive smaller supplies of fresh water, but they become specifically lighter than the under layers, which they protect from the warming influences of the atmosphere. The surface layers becoming ultimately warmer than the Atlantic current, the surface of the North Sea becomes higher, and the surface water spreads outwards into the Faeröe-Shetland Channel, checking the surface supply of Atlantic water.

Meanwhile, the mass of Atlantic water, collecting at the edge of the North Sea Bank, seeks entrance into the North Sea. Mixing with the cold bottom water already there, it increases its salinity but reduces its specific gravity by warming it, and, at a certain stage of mixture, the temperatures and salinities of the two waters combine to form a ridge or axis of maximum specific gravity. This axis, which probably runs N.E. from Shetland in the end of May or in June, turns slowly toward a N. to S. direction, and moves eastward. As it retreats, Atlantic water is gradually admitted round the north end of the Shetlands, passes down the east side of the groups, joins the tidal stream at the south end, and, guided by the axis of heavy water, is distributed along the East Coast of Scotland, probably during July and August. Later in the summer, as the axis retreats still further, the Atlantic water is probably distributed more towards the eastward, perhaps until the latter part of September, when the diminishing supply from the Faeröe Channel, and the increasing outflow from the eastern side of the North Sea, bring about a gradual return to the conditions with which we started.

Obviously the controlling conditions are complex, but it appears that the greater the winter cold and the spring supply of ice-cold water from the continent, the more slowly will Atlantic water penetrate into the North Sea below the surface; and the warmer the summer the more will the surface supply be checked. At the same time, the warmer the summer the larger the quantity of Atlantic water seeking admission, and the greater its thermal power to drive back the axis of maximum weight. To what extent the limits of these changes vary from year to year, and how far they affect the distribution of animal life, can only be determined by further investigation. In conclusion, I have to express my indebtedness to Dr H. R. Mill for valuable suggestions during the progress of our work.

APPENDIX I.

Notes from Daily Log.

August 1. Station II. Lead had touched bottom with 200 fathoms of line out, but contact uncertain.

2. Observations at noon gave positions 7 m. south of that by D. R. from departure at Balta Sound 8 A.M. on the 1st.
Bottom at Station VII. blue mud, with large crystals, apparently quartz.
Ship rolling pretty heavily all day.

3. At Balta Sound. Determined densities of samples 1 to 24.

4. Trial soundings for Station XII. at 11 P.M. and midnight gave too little water.

5. Water-bottle uncertain at Station XII. Ship rolling heavily. Shaped course at 3.30 A.M. for Foula Isle, to check position.

7. Lerwick Harbour. Determined densities of samples 25 to 30.

9. Left Lerwick at 5.30 A.M. Much hindered by fog.

10. Weather very foggy. Heavy swell. Position of Station XV. rather doubtful. Proceeded course N. 55° W. (true) from XV., 7½ miles, and sounded. Depth by lead 200 fms., by sounder 180 fms. (366 metres and 329 metres). Bottom black sand. Work had to be abandoned, owing to fog and heavy sea. Cruised to east of islands all night.

11. Ascertained position by observations at 10 A.M. Anchored at Trangjisvaag off Tveraa, Süderö, at 4 P.M. Determined densities of samples 31 to 36.

12. Collected samples at anchorage, No. 39 surface, No. 40 bottom. Determined densities of samples 37 to 40.
Made temperature observations in Trangjisvaag Fjord in afternoon.

14. Left Trangjisvaag 5.30 A.M.

15. Anchored in Lerwick harbour 6 P.M.

16. Determined densities of samples 41 to 51.

18. Observed aurora, white streamers, at 1 A.M., 3 miles from Station XXIII.

19. Kirkwall Harbour. Determined densities of samples 52 to 59. Thermometers examined and re-tested in ice. Weather stormy.

22. Weather still stormy. Abandoned trip to west side of Orkneys.

23. At Station XXVI. sounding gear was rigged on port side; davit on starboard side not being available.

24. Reached Aberdeen 11.10 A.M. Determined densities of samples 60 to 72.

November 14. Sea increasing rapidly. Action of water-bottle uncertain.

15. Position of Station III. obtained both from departure and meridian altitudes. At Station IV. depth by lead 185 fms., by sounder 165 fms. Found it impossible to get

up and down cast beyond 100 fms., owing to drift of ship. Lead showed (sand) that bottom had been reached; and as temperatures are identical up to 95 fms., confirmed by a second sounding at 100 fms., little error will be introduced by correcting depths greater than 100 fms. from Thomson sounder.

At Station VI. depth by sounder—first trial—165 fms.; second trial, 192 fms. Bottom doubtful first time, rock second. Ship drifting so fast it was impossible to get bottom with lead. Sample 80 taken with 170 fms. of line out. Sea rough, increasing, and beginning to break.

16. At Station VII., 1.30 A.M., heavy confused sea breaking over vessel made it impossible to work with more than 30 fms. of line. Also precluded use of Thomson sounder. Work had to be abandoned.
19. Lerwick Harbour. Determined densities of samples 73–76.
20. Reached Aberdeen 10.30 A.M.

February 6. South-westerly gale. Could not leave Aberdeen.

7. Left Aberdeen 2.30 P.M.

At Station XXVIII. ship rolling very heavily and drifting. Depth uncertain. Water-bottle not working well. Intermediate observations all made with light line and 7 lb. lead, which was much easier to work, and remained nearly vertical.

8. At 12.30 A.M. shifted course for Kirkwall. Sea and wind had increased so as to make sounding impossible.

Anchored in Inganess Bay at 3 P.M. Wind N.W., force 10, very heavy sea.

9. Determined densities of samples 83 and 84, also of 85, from anchorage in 4½ fms. Filled Pettersson's gas analysis tube, No. H.E. 305, with sample 84.

Weighed and went round to Kirkwall at 2 P.M.

13. Weighed at 11.30 A.M., and proceeded for Station XXVI. Heavy snow squalls. Confused sea.

At Station XXVI. position by cross bearings was about ½ mile S. of that given by D. R. Weather remaining very unsettled, and heavy sea. Decided to abandon cruise northwards, and to take line of soundings round Moray Firth.

14. At Station XXXIII. depth by lead 120 fms., by sounder 108 fms. Ship rolling very heavily. During first sounding ship slewed stern on to wind, and lead got ground with line considerably oblique. Depth by sounder probably correct. Ship drifting westward during sounding, as shown by Kinnaird's Head light. Water-bottle very uncertain in action.

April 29. Left Aberdeen 7.45 A.M.

30. Filled Pettersson's gas-tubes—

Tube No.	H.E. 311	with sample	97.
„	S.H. 163	„	99.
„	H.E. 312	„	99.

30. At Station II. no bottom with lead at 200 fms. or sounder at 310 fms. Ship rolling heavily. All observations

rather uncertain. Sample 102 taken with new bottle. As sea was increasing, proceeded at 6 P.M. for Station VIII.; speed, 6 knots.

At 8.15 P.M., having made 15 miles, shifted course, and proceeded for Station IV., at speed 4 knots, with jib and main trysail. Wind and sea decreasing slightly. Wind N.N.E. at midnight.

May

1. At Station IV. ship rolling heavily, but not drifting; all instruments working well. Tow-net put out at 10 A.M.; no way on ship; taken in at 11 A.M.

   At Station VII. bottom greyish-blue mud. Thomson lead was covered to 1 foot from end; ordinary lead about 2 feet. Sample 111 taken with new bottle.

   Filled gas-tubes—

   S.H. 78 with sample 110.
   H.E. 316 „ 109.

   First sounding with lead, 79 fms.; second, 82 fms.

   That with sounder taken while there was still some way on the ship.

2. Sounding for Station IX. was taken 3 miles from actual point by D. R. Wind and sea were increasing rapidly.

   Anchored in Lerwick harbour at 8 A.M.

   Determined densities of samples 97 to 115

3. Left Lerwick 6.30 A.M.

   At Station XXI. heavy squall struck the ship during first sounding, and bottom was only obtained at 65 fms. After squall had passed good cast gave 55 fms.

   Bearings off Sumburgh Head and Fair Isle showed strong set to S.E. during this sounding.

   At Station XXII. found it difficult to get consistent temperature results. Temperatures seemed to be varying with drift of ship. The curves given include all the readings.

   At 6.20 P.M., while sounding at Station XXIII., heavy squall struck the ship. At 6.30 'pocky cloud' was observed in rear of squall.

3. Put over tow-net at 8.40 P.M., and steamed at 4 knots; took it in 9.20 P.M.

4. Heavy gale and sea all day. Sea stove in box containing samples. Greater part of 117 lost; remainder probably mixed with other water.

   Further sounding had to be abandoned.

   Reached Aberdeen shortly after midnight.

5. Determined densities of samples 116 to 122.

   Filled gas-tubes—

   No. H.E. 320 with sample 116.
   „ S.H. 176 „ 121.

APPENDIX II.

Dr Murray reports that the only samples yielding results on examination were :—

Station I. Quartz, feldspar, augite.
„ VII. Fine blue mud with fragments of shells, quartz, feldspars.
„ XXI. Fragments of polyzoa, molluscs, basaltic rock, quartz, hornblende, feldspar.

APPENDIX III.

Tow-Net Collections.

Station IV., 9 to 10 A.M., 1st May 1894. 55 eggs of 5-bearded rockling ; 2 eggs of 3-bearded rockling.

New Station XXIII., 8.40 to 9.20 P.M,, 3rd May 1894. 3 eggs of plaice ; 5 eggs of haddock ; 18 eggs of cod ; 25 eggs of gurnard ; 7 sandeels, 23 to 27 mms.; *Parathemisto oblivia.*

Lerwick Harbour, 1 to 4 P.M., 3rd May 1894. No ova. Cypris stage of Cirripedes. Numerous small Medusæ, *e.g.*, *Phialidium*, young *Bougainvilleæ*, *Sarsia gemmifera*, and *Lizzia.*

TABLE I.—Temperature Observations.

Number of Station,	I.		II.		III.		IV.		V.		VI.		VII.		VIII.	
Position—Lat.,	61° 18′ N.		61° 47′ N.		61° 54′ N.		61° 57′ N.		61° 40′ N.		61° 53′ N.		61° 42′ N.		61° 10′ N.	
Position—Long.,	0° 54′ W.		0° 55′ W.		0° 7′ E.		1° 8′ E.		0° 54′ E.		1° 47′ E.		2° 23′ E.		1° 11′ E.	
Date,	Aug. 1.		Aug. 1.		Aug. 1 and 2.		Aug. 2.		Aug. 2.		Aug. 2.		Aug. 2.		Aug. 3.	
Time begun,	12.15 p.m.		5.30 p.m.		11.15 p.m.		8 a.m.		11.30 a.m.		4 p.m.		8.15 p.m.		3.45 a.m.	
,, ended,	2.30 p.m.		7.50 p.m.		1.30 a.m.		9 a.m.		1 p.m.		5.30 p.m.		10.40 p.m.		5.10 a.m.	
Depth by lead (fathoms),	95		194 (?)		130		115		109		152		200		86	
,, Thomson sounder (fathoms),	94		194		130		118		116		155		200		88	
Nature of bottom,	Sand.		(?)		Sand and stones.		Sand and stones.		Sand and stones.		Rock.		Blue mud and crystals.		Fine sand.	
Wind—Direction,	N.N.E.		N.		N.E.		E.		N.E.		N.E		N.E.		N.W.	
Wind—Force,	1–2		2		2		3–4		1		1		3		2	
Weather,	b. c. q.		o. p.		c.		p.		o. c. d.		o. d.		b. c.		b. c.	
Sea,	Smooth.		Smooth.		Smooth.		Smooth.		Swell.		Swell.		Swell.		Swell.	
Air Temperature F.,	54°·9		53°·0		53°		55°		53°		55°		55°		52°	
Temperatures=T° F. At Depths=d. (fathoms),	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.
	0	54·1	0	52·8	0	53·9	0	53·8	0	54·6	0	55·2	0	55·2	0	55·2
	5	54·0	5	52·9	10	54·0	5	53·8	5	54·3	5	53·8	5	53·5	5	55·0
	10	54·0	10	52·9	18	53·3	10	53.8	10	?	10	53·6	10	53·4	10	54·9
	14	54·0	15	52·6	19	51·4	13	53·8	13	54·1	15	53·8	15	53·6	15	54·8
	20	53·9	18	51·4	22	50·8	15	53·8	20	54·1	18	53·6	18	51·2	20	54·5
	23	53·5	20	51·4	27	50·4	16	53·7	25	52·6	20	52·9	20	50·0	21	52·8
	25	53·1	21	50·7	30	49·7	20	52·3	30	50·6	22	50·8	23	49·7	22	50·9
	26	51·0	22	50·6	34	49·6	22	51·6	39	49·5	24	50·5	25	49·6	24	49·3
	30	50·2	24	50·1	40	49·6	25	50·7	41	49·5	30	49·8	30	49·6	26	48·4
	35	50·0	30	49·9	49	49·4	26	50·3	44	49·7	40	49·6	40	49·2	31	48·2
	40	49·7	40	49·6	65	49·0	30	49·9	45	49·4	45	49·5	50	49·1	40	48·0
	45	49·3	49	50·0	80	8·9	40	49·6	50	49·8	49	49·3	60	49·1	51	47·7
	50	49·4	60	49·5	99	8·5	49	48·9	55	48·0	65	49·1	75	48·3	60	47·2
	55	49·4	70	49·3	129	48·5	55	48·9	64	48·9	80	48·7	90	48·2	66	47·0
	65	48·6	80	49·0			60	48·9	70	48·7	92	48·2	109	48·1	68	46·5
	74	48·5	94	48·8			75	48·5	79	48·7	110	48·0	120	47·6	70	45·8
	84	48·3	110	48·6			85	48·3	90	47·7	122	47·6	130	47·7	76	44·8
	94	48·6	120	48·5			99	47·8	108	47·7	134	47·4	150	47·2	77	44·4
			130	48·2			114	47·5			151	47·0	170	46·6	79	44·4
			140	47·9									180	44·9	85	44·4
			144	47·8									185	44·0		
			159	47·7									190	44·2		
			169	47·1									199	44·2		
			179	47·0												
			193	46·9												

TABLE I.—TEMPERATURE OBSERVATIONS—*continued.*

Number of Station,	IX.		X.		XI.		XII.		XIII.		XIV.		XV.		XVI.	
Position { Lat.,	60° 45′ N.		60° 54′ N.		60° 56′ N.		60° 21′ N.		61° 1′ N.		61° 20′ N.		61° 42′ N.		61° 20′ N.	
{ Long.,	0° 8′ W.		1° 15′ W.		2° 0′ W.		3° 10′ W.		3° 12′ W.		4° 22′ W.		5° 21′ W.		6° 30′ W.	
Date,	Aug. 3.		Aug. 4.		Aug. 4.		Aug. 5.		Aug. 9 and 10.		Aug. 10.		Aug. 10.		Aug. 11.	
Time begun,	9.40 a.m.		12.30 p.m.		4.15 p.m.		1.15 a.m.		9.20 p.m.		4.45 a.m.		9.45 a.m.		1.15 p.m.	
,, ended,	11.20 a.m.		1.15 p.m.		6 p.m.		3.30 a.m.		12.20 a.m.		6.40 a.m.		11.15 a.m.		2.10 p.m.	
Depth by lead (fathoms),	74		68		122		125		...		...		105		76	
,, Thomson sounder (fathoms),	70		67		115		129		...		...		...		75	
Nature of bottom,	Fine sand.		Sand and gravel.		Sand and gravel.		Sand and shells.		...		...		Sand and gravel.		Shells.	
Wind { Direction,	N.E.		N.N.W.		N.		N.N.W.		E.S.E.		...		S.E.		S.E.	
{ Force,	0 – 1		1		3		4 – 5		2		...		3		4	
Weather,	c.		r. g.		o.		q. c.		b.		o.		m°.		c.	
Sea,	Swell.		Moderate.		Moderate.		Moderate.		Swell.		Moderate.		Rough.		Moderate.	
Air Temperature F.,	56°·4		50°		51°·7		50°		56°		53°·4		55°		53°·9	
Temperatures = T° F., At Depths = d. (fathoms),	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T	d.	T.
	0	55·8	0	53·7	0	55·2	0	53·6	0	53·8	0	52·8	0	51·4	0	50·5
	5	54·2	5	53·7	5	55·0	5	53·6	5	53·8	5	52·8	10	51·4	5	49·8
	10	53·8	10	53·7	10	55·2	10	53·2	10	52·8	10	52·6	15	51·4	10	49·6
	18	53·9	15	53·7	12	54·1	13	53·7	15	53·2	15	52·1	20	51·1	12	49·3
	20	53·8	16	53·6	15	54·4	15	52·9	20	50·9	20	51·7	25	50·5	15	49·1
	23	53·8	17	53·5	18	54·4	20	52·5	25	51·1	25	51·2	29	49·9	17	49·0
	24	53·8	18	52·9	20	53·6	23	52·1	30	49·8	30	50·4	35	49·6	20	48·9
	25	52·8	20	52·1	23	51·8	25	51·7	35	48·8	34	47·9	45	49·3	25	48·6
	28	52·8	23	51·7	24	51·7	30	51·6	40	48·4	59	46·9	50	48·6	30	48·2
	30	51·1	25	50·0	27	51·6	34	51·1	50	47·1	80	46·1	54	47·2	40	47·8
	32	50·8	27	50·4	30	51·6	40	51·0	60	46·9	110	45·9	65	46·2	44	47·9
	35	48·8	30	49·2	39	50·6	49	50·3	80	46·0	140	45·7	74	45·9	47	46·8
	39	49·0	34	48·9	40	51·2	60	49·8	99	45·8	169	45·1	85	45·9	49	46·5
	44	48·7	39	48·8	45	50·4	65	50·5	120	...	185	43·2	103	45·9	56	46·4
	54	48·7	48	48·7	50	50·1	80	49·8	140	44·8	194	42·8			76	46·3
	64	48·7	58	48·7	59	49·9	90	49·4	160	44·2	406	32·9				
	73	48·7	67	48·7	62	49·8	95	...	180	43·5	413	32·7				
					69	49·5	109	49·2	199	42·5						
					74	49·2	124	49·2	245	40·6						
					92	49·1			295	37·7						
					121	48·9			342	34·7						
									406	31·1						
									413	30·9						

TABLE I.—Temperature Observations—*continued.*

Number of Station,	XVII.		XVIII.		XIX.		XX.		XXI.		XXII.		XXIII.		XXIV.	
Position { Lat.,	60° 37′ N.		60° 0′ N.		59° 45′ N.		59° 45′ N.		59° 45′ N.		59° 45′ N.		59° 32′ N.		59° 20′ N.	
Position { Long.,	5° 37′ W.		4° 45′ W.		3° 45′ W.		2° 34′ W.		1° 20′ W.		0° 9′ W.		1° 0′ E		0° 9′ W.	
Date,	Aug. 14.		Aug. 14.		Aug. 15.		Aug. 15.		Aug. 15.		Aug. 17.		Aug. 17 and 18.		Aug. 18.	
Time begun,	1.30 p.m.		9.10 p.m.		2.40 a.m.		8 a.m.		1.30 p.m.		5.50 p.m.		11.30 p.m.		4.40 a.m.	
,, ended,	4.15 p.m.		10.25 p.m.		4 a.m.		8.30 a.m.		1.45 p.m.		6.40 p.m.		12.30 a.m.		5.45 a.m.	
Depth by lead (fathoms),	¼δ¢		71		85		46		45		70		61		81	
,, Thomson sounder (fathoms),	...		76		75		47		44		70		58		75	
Nature of bottom,	...		Shells.		Sand.		Sand and shells.		Shells.		Sand (?)		Fine sand.		Mud.	
Wind { Direction,	S.S.W.		S.		S.W.		W.S.W.		W.		S.E.		S.		S.	
Wind { Force,	2		0–1.		2		2		2		5		4		3	
Weather,	f.		f.		c.		m.		f².		o. g.		o.		c.	
Sea,	Smooth.		Dead smooth.		Smooth.		Smooth.		Dead smooth.		Moderate.		Moderate.		Slight.	
Air Temperature F.,	58°·0.		57°·9.		55°		56°·4		56°·0		58°·9		59.		59°·2	
Temperatures=T° F., At Depths=d. (fathoms),	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.
	0	54·3	0	56·1	0	56·8	0	53·2	0	52·1	0	56·8	0	57·2	0	56·9
	5	54·1	5	55·9	5	56·0	5	53·2	5	51·8	5	56·6	5	57·4	5	56·8
	10	53·7	10	55·1	10	56·1	9	53·1	10	51·8	10	56·6	10	57·4	10	56·8
	15	53·3	15	54·8	12	56·0	15	53·2	15	51·8	15	55·2	15	56·6	15	55·6
	20	52·7	20	54·5	13	51·8	20	53·2	19	51·7	20	54·4	19	48·7	18	55·4
	25	52·0	25	52·6	15	51·7	26	53·2	25	51·8	23	52·5	23	48·4	21	55·4
	30	50·7	30	51·5	18	50·5	34	53·1	35	51·6	25	50·4	25	48·5	23	52·0
	35	49·3	34	50·1	20	50·4	45	53·0	44	51·7	27	48·3	27	47·1	25	49·0
	40	48·2	41	49·3	25	50·2					30	48·4	31	46·6	28	47·3
	50	47·0	50	49·2	29	49·4					35	46·3	35	44·2	30	46·2
	70	46·0	59	48·9	34	49·4					40	45·5	41	44·1	34	44·5
	99	42·4	70	48·7	45	49·4					50	44·1	50	43·8	40	43·7
	149	42·8			65	48·9					59	43·8	60	43·8	41	...
	199	42·3			84	48·9					69	43·7			44	42·9
	250	34·5													49	42·8
	300	32·8													61	42·8
	349	32·0													80	42·8
	402	31·3														

TABLE I.—TEMPERATURE OBSERVATIONS—*continued.*

Number of Station,	XXV.		XXVI.		XXVII.		XXVIII.		XXIX.		IX.		III.		IV.	
Position { Lat.,	59° 20′ N.		58° 41′ N.		58° 40′ N.		58° 15′ N.		57° 38′ N.		60° 45′ N.		61° 54′ N.		61° 57′ N.	
Position { Long.,	1° 25′ W.		2° 35′ W.		1° 10′ W.		1° 10′ W.		1° 20′ W.		0° 8′ W.		0° 7′ E.		1° 8′ E.	
Date,	Aug. 18.		Aug. 23.		Aug. 23.		Aug. 23.		Aug. 24.		Nov. 14.		Nov. 15.		Nov. 15.	
Time begun,	9.50 a.m.		1.30 p.m.		7.30 p.m.		11 p.m.		6.40 a.m.		3 p.m.		2.55 p.m.		7 p.m.	
,, ended,	10·40 a.m.		2 p.m.		8.10 p.m.		11.45 p.m.		7.20 a.m.		4 p.m.		3.50 p.m.		7.50 p.m.	
Depth by lead (fathoms),	66		36		57		56		46		63		194		185	
,, Thomson sounder (fathoms),	63		37		57		57		...		58		188		165	
Nature of bottom,	Sand and shells.		Sand and shells.		Sand.		Sand.		Sand and gravel.		Fine sand.		Sand and gravel.		Sand.	
Wind { Direction,	S.S.E.		S.S.W.		S.S.W.		S.W.		W.		N.N.E.		W.		S.S.W.	
Wind { Force,	4		[illegible]		[illegible]		1		2		6–7		4		4	
Weather,	c.		c.		o. r.		c.		c.		q. g. n°.		b. c.		o. q.	
Sea,	Slight.		Smooth.		Moderate.		Smooth.		Smooth.		Moderate.		Smooth.		Moderate.	
Air Temperature F.,	60°·4		59°		57°		59°		55°		42°·4		41°		41°·4	
Temperatures=T° F., At Depths=d. (fathoms),	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.
	0	54·7	0	55·0	0	53·6	0	55·0	0	57·0	0	48·0	0	48·2	0	48·0
	5	54·0	6	54·8	5	53·4	5	54·9	5	57·1	5	48·2	5	48·6	9	48·3
	10	52·7	10	54·5	10	53·0	10	54·9	10	55·8	9	48·4	10	48·7	20	48·5
	14	51·9	12	54·3	15	53·1	15	54·9	12	54·8	10	48·4	20	48·6	30	48·2
	20	51·9	16	54·1	17	52·8	16	51·8	14	53·6	20	48·2	29	48·6	39	48·3
	26	51·8	18	52·9	20	52·9	20	51·8	20	53·4	23	48·4	40	48·6	50	48·4
	30	51·7	19	52·9	21	52·7	25	51·4	25	53·2	24	48·4	60	48·6	85	48·4
	35	51·3	29	52·8	25	51·7	30	51·4	31	53·1	43	48·4	80	48·4	99	48·4
	40	50·7	35	52·8	30	51·1	36	49·8	39	52·5	62	48·5	99	48·3	111	48·4
	46	50·2			37	49·6	39	49·5	45	52·5			114	48·0	138	48·4
	48	48·8			39	49·2	44	49·3					134	47·7	164	48·4
	49	47·9			44	48·7	55	49·3					164	47·5		
	54	47·6			56	48·3							193	47·0		
	65	47·3														

TABLE I.—Temperature Observations—*continued.*

Number of Station	VI.		VII.		XXVIII.		XXVI.		XXX.		XXXI.		XXXII.		XXXIII.	
Position { Lat.	61° 53′ N.		61° 42′ N.		58° 15′ N.		58° 41′ N.		58° 19′ N.		57° 57′ N.		57° 51′ N.		57° 48′ N.	
Position { Long.	1° 47′ E.		2° 23′ E.		1° 10′ W.		2° 35′ W.		2° 59′ W.		2° 55′ W.		2° 31′ W.		2° 2′ W.	
Date	Nov. 15.		Nov. 16.		Feb. 7.		Feb. 13.		Feb. 13.		Feb. 13.		Feb. 13.		Feb. 14.	
Time begun	9.50 p.m.		1.30 a.m.		10 p.m.		2.15 p.m.		5.15 p.m.		8 p.m.		10.30 p.m.		1.30 a.m.	
,, ended	10.50 p.m.		2 a.m.		10.50 p.m.		2.40 p.m.		5.40 p.m.		9 p.m.		11.5 p.m.		2.20 a.m.	
Depth by lead (fathoms)	?		?		50		40		42		48		46		120 (?)	
,, Thomson sounder (fathoms)	180 (?)		?		45		38		42		44		42		108	
Nature of bottom	Rock (?)		?		Sand.		Fine sand.		Sand.		Sand.		Sand.		...	
Wind { Direction	S.S.W.		S.W.		N.W.		N.W.		N.W.		N.W.		N.		N.	
Wind { Force	5		7		4–7		5		4–6		6–7		3		3	
Weather	c. q.		c. q.		b. q².		sn. q.		sn°. q.		b. q.		c. q.		c. q.	
Sea	Rough.		Very rough.		Very rough.		Moderate.		Moderate.		Moderate.		Moderate.		Moderate.	
Air Temperature F.	41°·0		...		42°		34°·6		36°		36°		36°·7		...	
Temperatures = T° F. At Depths = d. (fathoms)	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.
	0	46·0	0	45·9	0	43·2	0	42·5	0	42·1	0	41·0	0	40·9	0	41·4
	15	47·8	9	46·2	5	43·7	5	42·6	5	42·6	5	40·7	5	41·2	5	41·6
	30	47·8	19	47·8	10	43·7	7	42·7	12	42·5	10	40·8	10	41·3	10	41·6
	75 (?)	48·0	29	47·8	20	43·7	10	42·6	22	42·6	15	40·6	16	41·4	20	41·7
	130 (?)	48·0			30	43·9	11	42·7	41	42·7	20	40·3	26	41·4	39	41·7
					49	43·9	14	42·7			24	40·9	45	41·5	70 (?)	41·7
							20	42·6			26	41·1			90 (?)	41·7
							39	42·8			28	40·8			119 (?)	41·7
											29	41·7				
											38	41·5				
											39	41·7				
											47	41·8				

TABLE I.—Temperature Observations—*continued.*

Number of Station,	I.		II.		IV.		VI.		VII.		VIII.		IX.		XXI.		XXII.		XXIII.	
Position {Lat.,	61° 18′ N.		61° 47′ N.		61° 54′ N.		61° 50′ N.		61° 42′ N.		61° 10′ N.		60° 45′ N.		59° 45′ N.		59° 45′ N.		59° 32′ N.	
Long.,	0° 54′ W.		0° 55′ W.		0° 57′ E.		1° 38′ E.		2° 23′ E.		1° 11′ E.		0° 8′ E.		1° 20′ W.		0° 9′ W.		1° 0′ E.	
Date,	April 30.		April 30.		May 1.		May 1.		May 1.		May 1.		May 2.		May 3.		May 3.		May 3.	
Time begun,	12.25 p.m.		4.55 p.m.		7.10 a.m.		10 a.m.		1.45 p.m.		7.35 p.m.		1.5 a.m.		9.10 a.m.		1.15 p.m.		5.50 p.m.	
,, ended,	1.15 p.m.		6 p.m.		8 a.m.		11 a.m.		2.50 p.m.		8.20 p.m.		2 a.m.		10 a.m.		2.15 p.m.		6.35 p.m.	
Depth by lead (fathoms),	101		...		102		189		210		82		62		55		79		61	
,, Thomson sounder (fthms.),	95		...		115		190		207		75		58		55		75		60	
Nature of bottom,	Sand.		...		Sand.		Rock.		Blue mud.		Sand.		Sand & shells.		Gravel.		Sand (?)		Fine sand.	
Wind {Direction,	N.		N.		N.E.		N.N.E.		N.N.W.		W.		S.W.		W.S.W.		W.		W.	
Force,	2		5–7		4		2		0–1		1		5		3–5		3–5		3–7	
Weather,	c.		o. p.		c.		c.		c.		b.		o. q.		c. q[2].		c. q.		c. q.	
Sea,	Smooth.		Rough.		Moderate.		Moderate.		Smooth.		Smooth.		Moderate.		Moderate.		Moderate.		Moderate.	
Air Temperature F.,	50°·4		44°·9		47°·2		48°·2		46°·0		46°·9		46°·8		45°·0		46°·6		44°·2	
Temperatures=T° F., At Depths=d. (fathoms),	d.	T.	d	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.	d.	T.
	0	48·0	0	47·8	0	47·8	0	47·4	0	45·7	0	47·0	0	47·0	0	45·4	0	45·3	0	45·2
	5	48·0	29(?)	47·8	4	47·5	10	47·5	10	46·9	9	46·6	4	47·0	5	44·7	10	45·2	4	44·9
	15	47·9	49(?)	47·6	10	47·2	30	47·1	30	46·8	10	46·6	10	46·8	9	45·3	20	45·0	10	44·9
	30	47·7	99(?)	47·0	20	47·6	50	47·1	50	46·5	22	46·6	22	46·9	14	45·3	25	45·3	15	44·9
	41	47·8	129(?)	46·8	29	47·4	70	46·5	70	46·3	30	46·4	29	46·8	25	45·3	30	44·9	20	44·8
	60	47·8	149(?)	46·0	42	47·1	79	46·6	85	45·8	39	46·2	42	46·5	39	45·4	35	44·8	25	44·6
	71	47·3	179(?)	46·1	72	46·9	89	46·4	100	45·9	42	46·0	61	46·1	45	45·2	39	44·0	30	44·5
	84	47·0	199(?)	44·2	101	47·0	110	46·0	110	45·1	45	45·6			54	45·3	44	44·6	34	44·6
	100	46·8					139	45·5	130	45·0	50	45·7					50	42·8	35	44·3
							149	45·3	160	44·8	59	45·9					59	42·8	38	43·7
							188	44·9	179	44·9	62	45·1					69	42·9	39	43·8
									189	44·6	69	45·5					78	42·9	41	43·7
									209	44·0	74	45·2							44	43·8
											81	45·1							60	43·8

TABLE II.—Temperatures from Curves. Degrees Centigrade.

Depth. Fathoms.	Depth. Metres.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.	XVIII.
		AUGUST 1893.																	
0	0	12·3	11·6	12·2	12·1	12·5	12·9	12·8	12·9	13·2	12·1	12·9	12·0	12·1	11·6	10·8	10·3	12·4	13·4
5	9	12·2	11·6	12·2	12·1	12·4	12·1	11·9	12·8	12·3	12·1	12·9	12·0	12·1	11·6	10·8	9·9	12·3	13·3
10	18	12·2	11·6	12·2	12·1	12·4	12·1	11·9	12·7	12·2	12·1	12·9	11·8	11·9	11·4	10·8	9·8	12·1	12·8
15	27	12·2	11·4	12·2	12·1	12·3	12·1	11·9	12·7	12·2	12·1	12·4	11·6	11·6	11·2	10·8	9·5	11·8	12·7
20	37	12·2	10·6	10·5	11·3	12·3	11·6	10·0	12·5	12·2	11·2	12·2	11·4	11·0	10·9	10·6	9·4	11·5	12·5
25	46	11·7	10·1	10·3	10·4	11·4	10·2	9·8	9·2	12·0	10·5	10·9	11·1	10·4	10·7	10·3	9·2	11·0	11·4
30	55	10·1	9·9	9·8	9·9	10·3	9·9	9·8	9·0	10·6	9·7	10·9	10·8	9·8	10·2	9·9	9·0	10·4	10·7
35	64	10·0	9·8	9·8	9·9	9·7	9·8	9·7	9·0	9·4	9·4	10·9	10·6	9·3	8·7	9·8	8·9	9·6	10·0
40	73	9·8	9·8	9·8	9·8	9·7	9·8	9·6	8·9	9·4	9·3	10·7	10·5	9·0	8·5	9·7	8·8	9·0	9·6
45	82	9·7	9·8	9·7	9·5	9·7	9·7	9·6	8·8	9·3	9·3	10·4	10·3	8·7	8·4	9·6	8·8	8·5	9·6
50	91	9·7	9·8	9·7	9·4	9·6	9·6	9·5	8·7	9·3	9·3	10·2	10·2	8·4	8·4	9·2	8·1	8·3	9·6
60	110	9·4	9·7	9·5	9·4	9·4	9·5	9·5	8·4	9·3	9·3	9·9	9·9	8·3	8·3	8·1	8·0	8·0	9·4
70	128	9·2	9·6	9·4	9·3	9·3	9·5	9·3	7·8	9·3	...	9·7	9·8	8·0	8·1	7·8	7·9	7·5	9·3
80	146	9·2	9·4	9·4	9·2	9·2	9·3	9·1	6·9	...	...	9·6	9·7	7·8	7·8	7·7	...	6·8	...
90	165	9·2	9·4	9·3	9·0	8·7	9·1	9·0	...	...	...	9·5	9·7	7·7	7·7	...	...	6·2	...
100	183	...	9·3	9·2	8·8	8·7	8·9	9·0	...	...	...	9·5	9·6	7·7	7·7	...	...	6·0	...
110	201	...	9·2	9·2	8·7	...	8·9	8·9	...	...	...	9·4	9·6	7·6	7·7	...	...	6·0	...
120	220	...	9·1	9·2	...	...	8·7	8·7	...	...	...	9·4	9·6	7·4	7·7	...	...	6·0	...
130	238	...	9·0	...	...	...	8·6	8·7	...	...	...	...	...	7·3	7·6	...	...	6·0	...
140	256	...	8·9	...	...	...	8·5	8·6	...	...	...	...	...	7·1	7·6	...	...	6·0	...
150	274	...	8·8	...	...	...	8·4	8·4	...	...	...	...	...	7·0	7·5	...	...	6·0	...
160	293	...	8·7	...	...	...	...	8·3	...	...	...	...	...	6·8	7·4	...	...	6·0	...
180	329	...	8·4	...	...	...	...	7·2	...	...	...	...	...	6·4	6·5	...	...	6·0	...
200	366	...	...	...	...	...	...	...	...	...	...	...	...	5·8	5·8	...	...	5·7	...
250	457	...	..	...	..	...	...	...	...	...	...	...	...	4·7	4·6	...	...	1·4	...
300	549	...	...	...	...	...	...	...	...	...	...	...	...	3·0	3·3	...	...	0·4	...
350	640	...	..	...	...	...	...	...	...	...	..	...	...	1·2	2·0	...	...	0·0	...
400	732	...	...	...	...	...	...	...	...	...	...	...	...	−0·3	0·7	...	...	−0·4	...
Bottom,		9·2	8·3	9·2	8·6	8·7	8·8	6·7	6·9	9·3	9·3	9·4	9·6	...	...	7·7	7·9	...	9·3

TABLE II.—Temperatures from Curves. Degrees Centigrade—*continued.*

Depth. Fathoms.	Depth. Metres.	XIX.	XX.	XXI.	XXII.	XXIII.	XXIV.	XXV.	XXVI.	XXVII.	XXVIII.	XXIX.	IX.	III.	IV.	VI.	VII.
		AUGUST 1893.											NOVEMBER 1893.				
0	0	13·8	11·8	11·2	13·8	14·0	13·8	12·6	12·8	12·0	12·8	14·0	8·9	9·0	8·9	7·8	7·7
5	9	13·5	11·8	10·9	13·7	14·1	13·8	12·1	12·7	11·9	12·7	13·9	9·0	9·2	9·0	8·6	7·8
10	18	13·4	11·8	10·9	13·7	14·1	13·8	11·5	12·6	11·7	12·7	13·2	9·1	9·2	9·1	8·8	8·0
15	27	10·9	11·8	10·9	13·2	13·7	13·1	11·1	12·3	11·6	12·7	12·0	9·1	9·2	9·1	8·8	8·5
20	37	10·2	11·8	10·9	12·4	9·2	13·1	11·1	11·6	11·5	10·9	11·9	9·1	9·2	9·1	8·8	8·9
25	46	10·1	11·8	10·9	10·2	8·9	9·6	11·0	11·6	11·1	10·9	11·8	9·1	9·2	9·1	8·8	8·9
30	55	9·7	11·8	10·9	8·9	8·2	8·0	10·9	11·6	10·4	10·8	11·7	9·1	9·2	9·1	8·8	8·9
35	64	9·7	11·8	10·9	8·0	6·8	6·9	10·7	11·6	9·9	10·0	11·6	9·1	9·2	9·1	8·8	...
40	73	9·7	11·8	10·9	7·4	6·7	6·4	10·4	...	9·6	9·7	11·4	9·1	9·2	9·1	8·8	...
45	82	9·7	11·8	10·9	7·0	6·6	6·1	10·1	...	9·3	9·6	11·4	9·1	9·2	9·1	8·8	...
50	91	9·6	...	...	6·7	6·6	6·0	8·8	...	9·2	9·6	...	9·1	9·2	9·1	8·8	...
60	110	9·5	...	...	6·5	6·6	6·0	8·6	...	...	...	...	9·2	9·1	9·1	8·8	...
70	128	9·4	...	...	6·5	...	6·0	...	...	...	...	...	...	9·1	9·1	8·8	...
80	146	9·4	...	...	...	...	6·0	...	...	...	...	...	...	9·1	9·1	8·9	...
90	165	...	...	...	...	...	...	...	...	...	...	...	...	9·1	9·1	8·9	...
100	183	..	...	...	..	...	...	...	...	...	...	...	...	9·1	9·1	8·9	...
110	201	...	...	...	...	...	...	...	...	...	...	...	...	9·0	9·1	8·9	...
120	220	...	...	...	...	...	...	...	...	...	...	...	...	8·8	9·1	8·9	...
130	238	...	...	...	...	...	...	...	...	...	...	...	...	8·7	9·1	8·9	...
140	256	...	...	...	...	...	...	...	...	...	...	...	...	8·7	9·1	...	...
150	274	...	...	...	...	...	...	...	...	...	...	...	...	8·7	9·1	...	...
160	293	...	...	...	...	...	...	...	...	...	...	...	...	8·6	9·1	...	...
180	329	...	...	...	...	...	...	...	...	...	...	...	...	8·5	...	...	...
200	366	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
250	457	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
300	549	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
350	640	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
400	732	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bottom,		9·4	11·8	10·9	6·5	6·6	6·0	8·5	11·6	9·1	9·6	11·4	9·2	8·3	9·1	8·9	...

TABLE II.—Temperatures from Curves. Degrees Centigrade—*continued.*

Depth. Fathoms.	Depth. Metres.	XXVIII.	XXVI.	XXX.	XXXI.	XXXII.	XXXIII.	I.	II.	IV.	VI.	VII.	VIII.	IX.	XXI.	XXII.	XXIII.
		FEBRUARY 1894.						MAY 1894.									
0	0	6·2	5·8	5·6	4·9	4·9	5·2	8·9	8·8	8·8	8·6	7·6	8·3	8·3	7·4	7·4	7·3
5	9	6·5	5·9	5·9	4·9	5·1	5·3	8·9	8·8	8·6	8·6	8·3	8·2	8·3	7·4	7·4	7·3
10	18	6·5	5·9	5·9	4·9	5·2	5·3	8·9	8·8	8·6	8·6	8·3	8·1	8·3	7·4	7·4	7·2
15	27	6·5	5·9	5·9	4·9	5·2	5·3	8·9	8·8	8·5	8·5	8·3	8·1	8·3	7·4	7·4	7·2
20	37	6·5	6·0	5·9	4·9	5·2	5·4	8·9	8·8	8·5	8·5	8·3	8·1	8·3	7·4	7·4	7·1
25	46	6·5	6·0	5·9	4·9	5·2	5·4	8·9	8·8	8·5	8·5	8·2	8·0	8·3	7·4	7·3	7·1
30	55	6·6	6·0	5·9	5·3	5·2	5·4	8·9	8·8	8·5	8·5	8·2	8·0	8·2	7·4	7·2	7·0
35	64	6·6	6·0	5·9	5·4	5·3	5·4	8·8	8·8	8·5	8·5	8·2	8·0	8·1	7·4	7·1	7·0
40	73	6·6	...	5·9	5·4	5·3	5·4	8·8	8·8	8·4	8·5	8·2	8·0	8·1	7·4	7·0	6·6
45	82	6·6	...	...	5·4	5·3	5·4	8·8	8·7	8·4	8·4	8·2	7·6	8·0	7·4	6·6	6·6
50	91	...	...	...	...	...	5·4	8·8	8·7	8·4	8·4	8·1	7·6	7·9	7·4	6·2	6·6
60	110	...	...	...	...	...	5·4	8·8	...	8·4	8·3	8·0	7·5	7·8	...	6·1	6·6
70	128	...	...	...	...	...	5·4	8·5	...	8·4	8·2	7·9	7·4	...	...	6·1	...
80	146	...	...	...	...	...	5·4	8·4	...	8·4	8·1	7·8	7·2	...	...	...	...
90	165	...	...	...	...	...	5·4	8·3	...	8·4	8·0	7·7	...	...	...	...	...
100	183	...	...	...	...	...	5·4	8·2	...	...	7·9	7·5	...	...	...	...	...
110	201	...	...	...	...	...	...	...	...	...	7·8	7·5	...	...	...	...	...
120	220	...	...	...	...	...	...	...	...	...	7·7	7·4	...	...	...	...	...
130	238	...	...	...	...	...	...	...	...	...	7·6	7·2	...	...	...	...	...
140	256	...	...	...	...	...	...	...	...	...	7·5	7·2	...	...	...	...	...
150	274	...	...	...	...	...	...	...	...	...	7·4	7·1	...	...	...	...	...
160	293	...	...	...	...	...	...	...	...	...	7·3	7·1	...	...	...	...	...
180	329	...	...	...	...	...	...	...	...	...	7·2	7·0	...	...	...	...	...
200	366	...	...	...	...	...	...	...	...	...	...	6·9	...	...	...	...	...
250	457	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
300	549	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
350	640	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
400	732	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bottom.		6·6	6·0	5·9	5·4	5·3	5·4	8·2	8·7	8·3	7·2	6·7	7·2	7·8	7·4	6·1	6·6

TABLE III.—Surface Observations.

Date.	Hour.	Course and Position.	Temperature.		No. of Sample.	Colour of Surface.
			F.	C.		
1893.						
Nov. 14.	10 a.m.	*a.* S.E., 12 m. from Noss Head,	48·5	9·2	501	...
,,	11 a.m.	*a.* N., 6 m.,	48·6	9·2	...	4–
,,	Noon.	*a.* N., 12 m.,	48·3	9·1	502	3+
,,	1 p.m.	*a.* N., 18 m.,	48·3	9·1	...	3
,,	2 p.m.	*a.* N., 24 m.,	48·3	9·1	503	3–
,,	5 p.m.	*a.* N., 42 m.,	49·1	9·5	504	...
,,	6 p.m.	*a.* N., 48 m. off Balta Island,	48·7	9·3	...	...
Nov. 15.	9 a.m.	*b.* 21 m. from Balta Sound,	47·9	8·8	...	...
,,	10 a.m.	*b.* 30 m., ,, ,, ,,	48·7	9·3	...	2+
,,	11 a.m.	*b.* 39 m., ,, ,, ,,	48·5	9·2	...	2+
,,	Noon.	*b.* 48 m., ,, ,, ,,	48·0	8·9	505	...
,,	1 p.m.	*b.* 57 m., ,, ,, ,,	48·5	9·2	...	3–
,,	2 p.m.	*b.* 66 m., ,, ,, ,,	48·0	8·9	...	...
,,	3.30 p.m.	At Station III.	48·2	9·0	75	2+
,,	5 p.m.	*c.* 10 m. from III.,	48·2	9·0	...	...
,,	6 p.m.	*c.* 19 m., ,,	48·0	8·9	...	...
,,	7 p.m.	At Station IV.	48·0	8·9	77	...
,,	9 p.m.	*d.* 10 m. from IV.,	46·2	7·9	...	...
,,	10 p.m.	At Station VI.	46·0	7·8	79	...
Nov. 19.	6 p.m.	*e.* Off Sumburgh Head,	47·5	8·6	506	...
,,	7 p.m.	*e.* 9 m. from Sumburgh Head,	46·9	8·3	...	...
,,	8 p.m.	*e.* 19 m. ,, ,, ,, off Fair Isle,	46·5	8·1	...	...
,,	9 p.m.	*e.* 28 m. from Sumburgh Head,	46·6	8·1	507	...
,,	10 p.m.	*e.* 38 m. ,, ,, ,,	46·5	8·1	...	...
,,	11 p.m.	*e.* 47 m. ,, ,, ,,	47·1	8·4	...	...
,,	Midnight.	*e.* 57 m. ,, ,, ,,	46·9	8·3	508	...
Nov. 20.	1 a.m.	*e.* 66 m. ,, ,, ,,	48·2	9·0	...	...
,,	2 a.m.	*e.* 76 m. ,, ,, ,,	47·4	8·6	...	...
,,	3 a.m.	*e.* 85 m. ,, ,, ,,	47·1	8·4	...	...
,,	4 a.m.	*e.* 95 m. ,, ,, ,,	46·9	8·3	...	...
,,	5 a.m.	*e.* 104 m. ,, ,, ,,	48·1	8·9	...	...
,,	6 a.m.	*e.* 114 m. ,, ,, ,,	47·9	8·8	...	...
,,	7 a.m.	*e.* 123 m. ,, ,, ,, off Kinnaird's Head,	46·9	8·3	...	...
,,	8 a.m.	Off Buchan Ness,	45·4	7·4	...	...
,,	9 a.m.	Off Newburgh,	45·7	7·6	...	...
1894.						
Feb. 7.	4 p.m.	Off Newburgh,	41·0	5·0	509	4–
,,	5 p.m.	Off Buchan Ness,	42·0	5·6	...	...
,,	6 p.m.	*f.* 9 m. from Buchan Ness,	42·7	5·9	510	...
,,	7 p.m.	*f.* 18 m. ,, ,, ,,	42·9	6·1	...	...
,,	8 p.m.	*f.* 27 m. ,, ,, ,,	43·2	6·2	511	...
,,	9 p.m.	*f.* 36 m. ,, ,, ,,	43·8	6·6	...	...
,,	10 p.m.	At Station XXVIII.	43·2	6·2	83	...
,,	Midnight.	7 m. N. from XXVIII.	43·9	6·6	...	...
Feb. 13.	3 p.m.	*g.* 3 m. from XXVI.,	42·5	5·8	...	...
,,	3.30 p.m.	*g.* 7 m. ,, ,,	43·0	6·1	512	...
,,	4 p.m.	*g.* 12 m. ,, ,,	42·0	5·6	...	...
,,	4.30 p.m.	*g.* 17 m. ,, ,,	43·6	6·4	513	...
,,	5 p.m.	*g.* 21 m. ,, ,,	43·5	6·4	...	...
,,	6 p.m.	At Station XXX.	43·0	6·1	88	...
,,	6.30 p.m.	*h.* 4 m. from XXX.,	42·9	6·1	...	...
,,	7 p.m.	*h.* 9 m. ,, ,,	42·1	5·6	514	...
,,	7.30 p.m.	*h.* 14 m. ,, ,,	41·2	5·1	...	...
,,	8 p.m.	At Station XXXI.	41·0	5·0	90	...
,,	9.30 p.m.	*i.* 5 m. from XXXI.,	41·0	5·0	515	...
,,	10 p.m.	*i.* 10 m. ,, ,,	40·9	4·9	516	...
,,	10.30 p.m.	At Station XXXII.	40·9	4·9	93	...
,,	11.30 p.m.	*j.* 3 m. from XXXII.,	42·0	5·6	517	...
,,	Midnight.	*j.* 6 m. ,, ,,	41·7	5·4	...	...
Feb. 14.	12.30 a.m.	*j.* 9 m. ,, ,,	41·7	5·4	...	...
,,	1.30 a.m.	At Station XXXIII.	41·4	5·2	95	...
,,	3 a.m.	*k.* 5 m. from XXXIII.,	40·2	4·6	...	...
,,	3.30 a.m.	*k.* 10 m. ,, ,,	40·8	4·9	518	...
	4 a.m.	*k.* 15 m. ,, ,,	40·9	4·9	...	...
,,	4.30 a.m.	*k.* 20 m. ,, ,,	40·9	4·9	...	...

TABLE III.—SURFACE OBSERVATIONS—*continued.*

Date.	Hour.	Course and Position.	Temperature.		No. of Sample.	Colour of Surface.
			F.	C.		
1894.						
Feb. 14.	5 a.m.	Off Buchan Ness,	40·1	4·5	...	...
,,	5.30 a.m.	5 m. S.S.W. from Buchan Ness,	40·1	4·5	...	...
,,	6 a.m.	10 m. ,, ,, ,,	40·0	4·4	...	...
,,	7 a.m.	Off Aberdeen,	39·6	4·2	...	...
April 29.	10 a.m.	Off Buchan Ness,	43·9	6·6	519	3·5
,,	Noon.	*l.* 20 m. from Buchan Ness,	44·0	6·7	520	3·
,,	2 p.m.	*l.* 39 m. ,, ,, ,,	46·3	7·9	521	3·
,,	4 p.m.	*l.* 57 m. ,, ,, ,,	46·2	7·9	522	3·
,,	6 p.m.	*l.* 75 m. ,, ,, ,,	46·1	7·8	523	3·
,,	8 p.m.	*l.* 93 m. ,, ,, ,,	46·1	7·8	524	...
,,	10 p.m.	*l.* 111 m. ,, ,, ,,	46·1	7·8	525	...
,,	Midnight.	*l.* 129 m. ,, ,, ,,	46·0	7·8	526	...
April 30.	1 a.m.	*l.* 138 m. ,, ,, ,,	45·3	7·4	...	...
,,	2 a.m.	Sumburgh Head abeam,	46·0	7·8	527	...
,,	4 a.m.	Bard of Bressay abeam,	47·0	8·3	...	...
,,	6 a.m.	Off Whalsay Skerries,	?	...	528	...
,,	8 a.m.	Off Balta Island,	47·0	8·3	529	...
,,	10 a.m.	Flugga Lt. 10 m. S.,	47·8	8·8	530	1·5
,,	12.25 p.m.	At Station I.	48·0	8·9	97	1·5
,,	2.30 p.m.	*m.* 12 m. from I.,	48·0	8·9	531	...
,,	4 p.m.	*m.* 23 m. ,, ,,	48·2	9·0	...	...
,,	4.55 p.m.	At Station II.	47·8	8·8	100	...
,,	10 p.m.	*n.* 7 m. from Lat. 61° 39′ N., Long. 0° 30′ W.,	47·0	8·3	532	...
,,	Midnight.	*n.* 15 m. from Lat. 61° 39′ N., Long. 0° 30′ W.,	47·0	8·3	...	...
May 1.	2 a.m.	*n.* 23 m. from Lat. 61° 39′ N., Long. 0° 30′ W.,	47·5	8·6	...	...
,,	7.10 a.m.	At Station IV.	47·8	8·8	103	2·
,,	9 a.m.	*d.* 9 m. from IV.,	47·8	8·8	533	...
,,	10 a.m.	At Station VI.	47·4	8·6	106	2·
,,	Noon.	*o.* 9 m from VI.,	47·5	8·6	534	...
,,	1 p.m.	*o.* 18 m. ,, ,,	47·0	8·3	535	2·
,,	2 p.m.	At Station VII.	45·7	7·6	109	2·5
,,	4 p.m.	*p.* 10 m. from VII.,	47·5	8·6	536	...
,,	5 p.m.	*p.* 19 m. ,, ,,	47·3	8·5	...	...
,,	6 p.m.	*p.* 28 m. ,, ,,	46·9	8·3	537	...
,,	7 p.m.	*p.* 38 m. ,, ,,	46·8	8·2	...	...
,,	7.35 p.m.	At Station VIII.	47·0	8·3	112	...
,,	9 p.m.	*q.* 6 m. from VIII.,	47·0	8·3	...	...
,,	10 p.m.	*q.* 15 m. ,, ,,	47·0	8·3	538	...
,,	Midnight.	*q.* 24 m. ,, ,,	46·9	8·3	539	...
May 2.	1 a.m.	At Station IX.	47·0	8·3	114	...
May 3.	9 a.m.	At Station XXI.	45·4	7·4	116	...
,,	11 a.m.	*r.* 9 m. from XXI.,	45·5	7·5	540	...
,,	Noon.	*r.* 18 m. ,, ,,	45·6	7·6	...	...
,,	1.15 p.m.	At Station XXII.	45·3	7·4	118	...
,,	4 p.m.	*s.* 12 m. from XXII.,	44·8	7·1	...	...
,,	5 p.m.	*s.* 21 m. ,, ,,	44·8	7·1	...	...
,,	6 p.m.	At Station XXIII.	45·2	7·3	121	...
,,	8 p.m.	*t.* 8 m. from XXIII.,	44·6	7·0	...	...
,,	9 p.m.	*t.* 12 m. ,, ,,	44·9	7·2	541	...

TABLE OF COURSES REFERRED TO IN TABLE III.

(*All Bearings Magnetic.*)

a. From 12 m. S.E. of Noss Head to outside Balta Island.
b. From Balta Sound to Station III.
c. Stations III. to IV.
d. ,, IV. to VI.
e. Sumburgh Head to Buchan Ness.
f. Buchan Ness to Station XXVIII.
g. Stations XXVI. to XXX.
h. ,, XXX. to XXXI.
i. ,, XXXI. to XXXII.
j. ,, XXXII. to XXXIII.
k. Stations XXXIII. to Buchan Ness.
l. Buchan Ness to Sumburgh Head.
m. Stations I. to II.
n. Lat. 61° 39′ N., Long., 0° 30′ W. to Station IV.
o. Stations VI. to VII.
p. ,, VII. to VIII.
q. ,, VIII. to IX.
r. ,, XXI. to XXII.
s. ,, XXII. to XXIII.
t. Course S. 88° W. from XXIII.

TABLE IV.—Densities and Salinities.

Sample.	Station.	Depth. Fathoms.	Depth. Metres.	t.	${}_4S_t$.	${}_4S_{15}$ Corrected.	Probable Error ×100.	Salinity.	T.	${}_4S_T$.
				August 1893.						
1	I.	95	174	13·82	26·70	26·31	1·2	35·33	9·1	27·42
2	,,	15	27	14·00	26·70	26·36	2·4	35·40	12·2	26·94
3	,,	0	0	14·27	26·64	26·36	0·8	35·40	12·3	26·92
4	II.	194	355	13·35	26·74	26·25	1·5	35·25	8·3	27·48
5	,,	0	0	13·65	26·66	26·24	1·5	35·23	11·6	26·92
6	III.	130	238	13·26	26·79	26·28	1·4	35·29	9·2	27·37
7	,,	25	46	13·10	26·85	26·31	1·0	35·33	10·3	27·23
8	,,	0	0	13·65	26·74	26·32	0·6	35·34	12·2	26·90
9	IV.	115	210	12·95	26·80	26·23	0·6	35·22	8·6	27·41
10	,,	15	27	13·12	26·79	26·25	0·3	35·25	12·1	26·85
11	,,	0	0	13·16	26·81	26·28	1·0	35·29	12·1	26·88
12	V.	109	199	13·60	26·72	26·29	0·6	35·30	8·7	27·46
13	,,	0	0	13·13	26·78	26·25	1·0	35·25	12·4	26·79
14	VI.	152	278	13·12	26·78	26·25	1·0	35·25	8·3	27·48
15	,,	30	55	12·63	26·92	26·29	1·0	35·30	9·9	27·27
16	,,	18	33	12·70	26·43	25·81	1·2	34·67	12·0	26·42
17	,,	0	0	12·93	26·40	25·83	1·2	34·69	12·9	26·26
18	VII.	200	366	12·43	26·90	26·23	0·4	35·22	6·8	27·67
19	,,	0	0	12·44	25·74	25·07	0·9	33·71	12·9	25·50
20	VIII.	86	157	12·53	26·94	26·29	1·4	35·30	6·9	27·72
21	,,	27	49	12·50	27·00	26·35	1·9	35·38	9·1	27·45
22	,,	0	0	12·63	26·80	26·17	2·3	35·14	12·9	26·61
23	IX.	74	135	12·26	27·05	26·35	2·5	35·38	9·3	27·42
24	,,	35	64	12·43	27·04	26·38	1·8	35·42	9·3	27·45
24*a*	,,	0	0	12·23	27·10	26·39	1·2	35·43	13·2	26·78
25	X.	68	124	11·07	27·22	26·30	1·3	35·31	9·3	27·37
26	,,	0	0	11·45	27·11	26·28	1·0	35·29	12·1	26·88
27	XI.	0	0	11·62	27·16	26·35	0·6	35·38	12·9	26·80
28	,,	115	210	11·64	27·17	26·36	0·9	35·40	9·4	27·42
29	XII.	125	229	11·74	27·13	26·34	0·9	35·36	9·6	27·36
30	,,	0	0	12·00	27·08	26·33	0·9	35·35	12·0	26·94
31	XIII.	200	366	13·95	26·54	26·18	0·9	35·16	5·8	27·75
32	,,	0	0	14·15	26·54	26·22	0·7	35·21	12·1	26·82
33	XIV.	200	366	13·75	26·64	26·24	0·7	35·23	6·0	27·78
34	,,	0	0	14·20	26·59	26·28	1·3	35·29	11·6	26·97
35	XV.	105	192	14·15	26·61	26·29	1·2	35·30	7·7	27·60
36	,,	0	0	14·20	26·54	26·23	0·3	35·22	10·8	27·05
37	XVI.	76	139	14·80	26·48	26·30	2·1	35·31	7·9	27·58
38	,,	0	0	14·88	26·42	26·25	0·9	35·25	10·3	27·16
39	Trangjisvaag.	0	0	13·10	26·50	25·96	0·6	34·86	11·0	26·74
40	,,	15	27	12·78	26·81	26·22	1·8	35·21	9·5	27·26
41	XVII.	200	366	14·78	26·45	26·27	1·0	35·27	5·7	27·84
42	,,	0	0	15·10	26·37	26·25	1·5	35·25	12·4	26·79
43	,,	400	732	14·96	26·26	26·11	0·8	35·06	−0·4	28·23
44	XVIII.	71	130	14·72	26·54	26·34	0·8	35·36	9·3	27·41
45	,,	0	0	14·98	26·43	26·29	1·1	35·30	13·4	26·63
46	XIX.	85	156	14·92	26·47	26·31	1·3	35·33	9·4	27·37
47	,,	0	0	15·00	26·17	26·03	1·6	34·96	13·8	26·28
48	XX.	46	84	15·20	26·14	26·04	0·9	34·97	11·7	26·70
49	,,	0	0	15·18	26·14	26·04	0·9	34·97	11·8	26·68
50	XXI.	45	82	13·72	26·65	26·24	1·1	35·23	10·9	27·05
51	,,	0	0	13·92	26·70	26·33	1·1	35·35	11·2	27·09
52	XXII.	70	128	16·33	25·98	26·13	1·5	35·09	6·5	27·61
53	,,	0	0	16·28	25·98	26·14	1·7	35·10	13·8	26·39
54	XXIII.	61	111	17·20	25·50	25·86	0·9	34·73	6·6	27·31
55	,,	0	0	17·00	25·47	25·78	0·4	34·63	14·0	25·99
56	XXIV.	81	148	17·55	25·75	26·18	0·5	35·16	6·0	27·71
57	,,	0	0	17·30	25·82	26·20	0·6	35·18	13·8	26·45
58	XXV.	66	121	17·37	25·85	26·25	0·9	35·25	8·5	27·44
59	,,	0	0	17·60	25·79	26·23	0·3	35·22	12·6	26·73
60	XXVI.	36	66	13·30	26·60	26·10	1·2	35·05	11·6	26·78
61	,,	20	37	13·12	26·65	26·11	0·6	35·06	11·6	26·79
62	,,	0	0	13·12	26·45	25·91	1·1	34·80	12·8	26·37
63	,,	15	27	13·20	26·59	26·07	0·5	35·01	12·3	26·62
64	XXVII.	57	104	13·22	26·75	26·23	1·0	35·22	9·2	27·32

TABLE IV.—Densities and Salinities—*continued.*

Sample.	Station.	Depth. Fathoms.	Depth. Metres.	t.	S_t.	$_4S_{15}$ Corrected.	Probable Error × 100.	Salinity.	T.	$_4S_T$.
				August 1893.						
65	XXVII.	20	37	13·22	26·76	26·24	0·8	35·23	11·6	26·93
66	,,	0	0	13·32	26·73	26·23	0·3	35·22	13·0	26·65
67	XXVIII.	56	102	13·25	26·69	26·18	1·2	35·16	9·6	27·19
68	,,	0	0	13·50	26·56	26·11	0·7	35·06	12·8	26·57
69	,,	20	37	13·62	26·56	26·13	1·8	35·09	11·0	26·91
70	XXIX.	46	84	13·97	26·27	25·92	1·0	34·81	11·4	26·63
71	,,	0	0	14·22	26·00	25·69	1·2	34·52	13·9	25·92
72	,,	15	27	14·50	26·13	25·88	0·8	34·76	12·0	26·49
				November 1893.						
73	IX.	0	0	5·70	28·03	26·21	1·6	35·20	8·9	27·34
74	,,	63	115	...	...	...	...	...	...	...
75	III.	0	0	5·00	28·14	26·26	0·7	35·26	9·0	27·37
76	,,	194	355	1·70	28·40	26·21	1·2	35·20	8·3	27·42
77	IV.	0	0	4·30	28·17	26·19	1·5	35·17	8·9	27·32
78	,,	[185]	[339]	4·30	28·27	26·29	1·1	35·30	9·1	27·39
79	VI.	0	0	4·80	26·82	24·95	1·4	33·56	7·8	26·21
80	,,	[170]	[311]	4·80	27·03	25·17	1·9	33·84	8·9	26·28
81	VII.	0	0	5·40	26·58	24·79	2·9	33·36	7·7	26·07
82	,,	30	55	5·50	26·69	24·91	1·5	33·45	8·8	26·03
				February 1894.						
83	XXVIII.	0	0	9·50	27·25	26·10	1·1	35·05	6·2	27·60
84	,,	50	91	9·17	27·24	26·06	1·9	35·00	6·6	27·52
85	Inganess Bay.	4½	8	7·17	27·30	25·80	1·6	34·66	...	...
86	XXVI.	0	0	...	...	26·00	...	34·92	5·8	27·55
87	,,	40	73	...	...	25·99	...	34·90	6·0	27·52
88	XXX.	0	0	...	...	25·84	...	34·71	5·6	27·41
89	,,	42	77	...	...	25·84	...	34·71	5·9	27·38
90	XXXI.	0	0	...	...	25·74	...	34·58	5·0	27·37
91	,,	48	88	...	...	25·84	...	34·71	5·4	27·44
92	,,	25	46	...	...	25·82	...	34·68	5·0	27·46
93	XXXII.	0	0	...	...	25·79	...	34·64	4·9	27·43
94	,,	46	84	...	...	25·81	...	34·67	5·3	27·42
95	XXXIII.	0	0	...	...	25·87	...	34·75	5·2	27·49
96	,,	(108)	(198)	...	...	25·86	...	34·73	5·4	27·46
				May 1894.						
97	I.	0	0	10·40	27·31	26·31	2·2	35·33	8·9	27·44
98	,,	30	55	10·40	27·28	26·28	2·0	35·29	8·7	27·44
99	,,	101	185	10·60	27·29	26·32	0·9	35·34	8·2	27·55
100	II.	0	0	12·05	27·04	26·33	1·3	35·35	8·8	27·48
101	,,	200(?)	366(	11·90	26·97	26·23	2·8	35·22	6·8	27·67
102	,,	30	55	...	...	26·32	...	35·34	8·7	27·48
103	IV.	0	0	11·50	27·12	26·31	1·9	35·33	8·8	27·46
104	,,	102	187	11·35	27·14	26·31	1·8	35·33	8·3	27·53
105	,,	30	55	...	...	26·35	...	35·38	8·6	27·53
106	VI.	0	0	11·57	27·12	26·33	0·5	35·35	8·6	27·51
107	,,	189	346	11·77	27·02	26·26	0·5	35·26	7·2	27·64
108	,,	30	55	11·97	27·04	26·32	1·8	35·34	8·4	27·52
109	VII.	0	0	13·02	25·93	25·41	1·5	34·15	7·6	26·71
110	,,	210	384	13·32	26·62	26·16	1·3	35·13	6·7	27·60
111	,,	30	55	...	...	26·24	...	35·23	8·2	27·47
112	VIII.	0	0	13·74	26·70	26·33	1·6	35·35	8·3	27·55
113	,,	82	150	13·57	26·79	26·38	2·1	35·42	7·3	27·73
114	IX.	0	0	13·67	26·79	26·40	2·1	35·44	8·3	27·62
115	,,	62	113	13·70	26·78	26·40	1·4	35·44	7·8	27·69
116	XXI.	0	0	9·35	27·51	26·36	1·0	35·40	7·4	27·71
117	,,	55	101	...	...	26·28	...	35·29	7·4	27·63
118	XXII.	0	0	9·28	27·46	26·27	1·6	35·27	7·4	27·62
119	,,	79	145	9·51	27·37	26·23	1·4	35·22	6·1	27·76
120	,,	40	73	9·16	27·28	26·08	2·2	35·03	6·7	27·52
121	XXIII.	0	0	10·08	27·29	26·24	1·5	35·23	7·3	27·60
122	,,	61	111	10·08	27·41	26·36	1·4	35·40	6·6	27·82
123	,,	45	82	...	...	26·30	...	35·31	6·6	27·76

TABLE V.—Densities and Salinities. Additional Surface Samples.

1	2	3	4	5	6
No. of Sample.	x.	$_4S_{15}$ from (2), or Sprengel.	p (from 3).	T.	$_4S_T$.
501	19·521	26·27	35·27	9·2	27·36
502	19·557	26·31	35·33	9·1	27·41
503	19·552	26·30	35·31	9·1	27·40
504	19·583	26·35	35·38	9·5	27·39
505	19·596	26·37	35·41	8·9	27·51
506	19·547	26·30	35·31	8·6	27·48
507	19·534	26·28	35·29	8·1	27·52
508	19·528	26·28	35·29	8·3	27·50
509	...	25·65	34·47	5·0	27·28
510	...	25·90	34·79	5·9	27·43
511	...	26·00	34·92	6·2	27·50
512	...	25·88	34·76	6·1	27·39
513	...	25·81	34·67	6·4	27·29
514	...	25·89	34·77	5·6	27·46
515	...	25·84	34·71	5·0	27·48
516	...	25·72	34·56	4·9	27·36
517	...	25·87	34·75	5·6	27·44
518	...	25·37	34·10	4·9	27·00
519	...	25·81	34·67	6·6	27·26
520	...	25·86	34·73	6·7	27·30
521	...	26·04	34·97	7·9	27·31
522	...	26·08	35·03	7·9	27·35
523	...	26·20	35·18	7·8	27·48
524	...	26·18	35·16	7·8	27·46
525	...	26·27	35·27	7·8	27·56
526	...	26·28	35·29	7·8	27·57
527	...	26·34	35·36	7·8	27·63
528	...	26·34	35·36	...	...
529	...	26·37	35·41	8·3	27·59
530	...	26·38	35·42	8·8	27·53
531	...	26·36	35·40	8·9	27·49
532	...	26·34	35·36	8·3	27·56
533	...	26·35	35·38	8·8	27·50
534	...	26·34	35·36	8·6	27·51
535	...	26·32	35·34	8·3	27·54
536	...	26·34	35·36	8·6	27·51
537	...	26·34	35·36	8·3	27·56
538	...	26·34	35·36	8·3	27·56
539	...	26·34	35·36	8·3	27·56
540	...	26·34	35·36	7·5	27·68
541	...	26·24	35·23	7·2	27·61

TABLE VI.—Mr Anderson's Report on 'Jackal' Samples.

No. of Sample.	Sprengel. $t.$	S	χ.	Alkalinity.	No. of Sample.	Sprengel. $t.$	S_t.	χ.	Alkalinity.
4	0°	28·56	19·564	50·84	104	17·5	27·02	..	..
5	0°	28·53	19·572	51·12	105	15·	27·20	..	..
14	0°	28·49	19·546	50·85	105	17·5	27·06	..	..
16	0°	28·04	19·249	50·48	106	15·	27·20	..	..
17	0°	28·02	19·227	51·03	106	17·5	27·03	..	..
18	0°	28·46	19·533	49·43	107	15·	27·13	..	..
19	0°	27·24	18·723	49·93	107	17·5	26·97	..	..
33	0°	28·44	19·528	51·10	108	15·	27·19	..	..
34	0°	28·52	19·547	50·40	108	17·5	27·04	..	..
41	0°	28·42	19·485	51·33	109	15·	26·22	..	..
42	0°	28·45	19·522	51·18	109	17·5	26·09	..	..
43	0°	28·33	19·428	50·76	110	15·	27·10	..	..
73	..	..	19·525	..	110	17·5	26·94	..	..
74	..	..	19·170	..	111	15·	27·10	..	..
75	..	..	19·558	..	111	17·5	26·95	..	..
76	..	..	19·525	..	112	15·	27·18	..	..
77	..	..	19·602	..	112	17·5	27·02	..	..
78	..	..	19·575	..	113	15·	27·18	..	..
79	..	..	18·593	..	113	17·5	27·02	..	..
80	..	..	18·779	..	114	15·	27·21	..	..
81	..	..	18·477	..	114	17·5	27·04	..	..
82	..	..	18·585	..	115	15·	27·19	..	..
97	15·	27·20	..	..	115	17·5	27·04	..	..
97	17·5	27·06	..	..	116	15·	27·16	..	..
98	15·	27·19	..	..	116	17·5	27·00	..	..
98	17·5	27·03	..	..	117	15·	27·14	..	..
99	15·	27·18	..	..	117	17·5	26·99	..	..
99	17·5	27·03	..	..	118	15·	27·18	..	..
100	15·	27·20	..	..	118	17·5	27·02	..	..
100	17·5	27·01	..	..	119	15·	27·14	..	..
101	15·	27·08	..	..	119	17·5	26·98	..	..
101	17·5	26·95	..	..	121	15·	27·14	..	..
102	15·	27·18	..	..	121	17·5	26·98	..	..
102	17·5	27·02	..	..	122	15·	27·17	..	..
103	15·	27·20	..	..	122	17·5	27·02	..	..
103	17·5	27·04	..	..	123	15·	27·16	..	..
104	15·	27·17	..	..	123	17·5	27·00	..	..

TABLE VII.—Chlorine Factors for Sea-Waters of Different Salinity.

χ.	p.	κ.	Author.	Sea Water from	Δp.
19·56	35·32	1·806	Tornöe, . .	North Atlantic, Lat. 73°, . .	0·00
19·47	35·21	1·808	,, . .	,, Lat. 68°, . .	−0·03
19·38	35·03	1·808	,, . .	,, Lat. 76°, . .	−0·01
19·374	35·01	1·807	Ekman, . .	Skagerack, ...	0·00
16·460	29·850	1·813	Forsberg, .	,, ...	−0·06
14·254	25·87	1·815	Ekman, . .	,, ...	−0·03
11·509	20·91	1·817	,, . .	,, ...	−0·02
5·655	10·317	1·824	Forsberg, .	Baltic, ...	0·00
3·764	6·905	1·834	,, .	,, ...	−0·03

TABLE VIII.—Samples used as Standards.

Analyses by Professor Pettersson, with factors computed therefrom.

1	2	3	4	5	6	7	8	9	10
No. of Sample.	Locality.	Depth Fms.	χ	$_{15}S_{15}$	$_{4}S_{15}$	p	σ	s_1	s
1	Skagerack,	33	19·517	1027·15	1026·29	35·26	1299	1341	1342
2	,,	164	19·415	27·01	26·14	35·07	1298	1342	1343
3	,,	46	19·335	26·98	26·12	34·93	1295	1338	1343
4	,,	22	19·171	26·68	25·82	34·64	1298	1342	1343
5	,,	3	18·320	25·54	24·68	33·12	1297	1342	1346
6	Kattegat,	16	17·040	23·77	22·90	30·83	1297	1346	1349
7	Skagerack,	11	17·005	23·71	22·85	30·76	1297	1346	1349
8*	Fehmern Belt,	11	16·277	22·61	21·75	29·46	1303	1354	1352
9	Skagerack,	3	15·421	21·55	20·68	27·93	1296	1351	1354
10	Kattegat,	11	14·220	19·83	18·97	25·77	1300	1358	1359
11	,,	6	12·928	18·05	17·19	23·46	1300	1365	1365
12	,,	11	12·628	17·61	16·75	22·93	1302	1369	1367
13*	Fehmern Belt,	8	12·571	17·50	16·65	22·81	1303	1370	1367
14	Kattegat,	13	11·263	15·70	14·84	20·45	1303	1378	1375
15	,,	0	9·473	13·23	12·37	17·25	1304	1395	1389
16*	Fehmern Belt,	0	7·067	09·87	09·03	12·86	1303	1424	1423
	Means,	..	..	..	..	..	1300	..	..

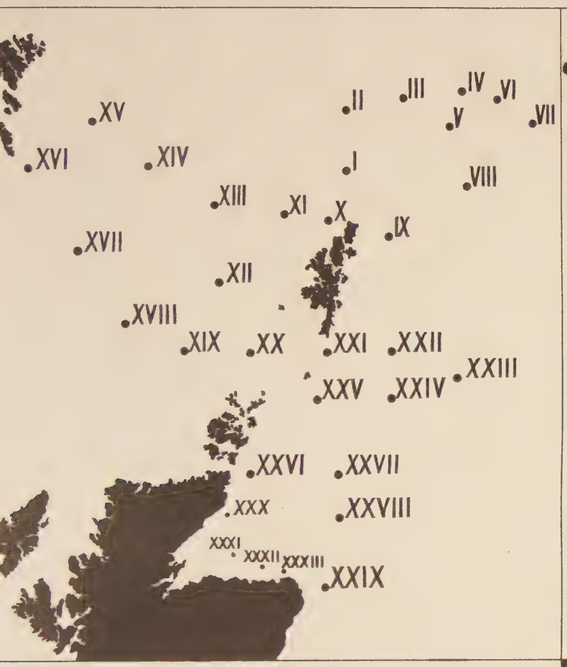
Samples marked * were supplied to Professor Pettersson by Professor Krümmel.

TABLE IX.—Mr Anderson's Analyses of *Jackal* Samples, with the Hydrometer Corrections Deduced.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	No. of Sample.	$_0S_0$ (Sprengel.)	$_4S_{15}$ (from 2.)	$_4S_{15}$ (Hydrometer.)	t	Diff. 3 – 4.	χ (Anderson.)	χ (Pettersson.)	p $\kappa\times(7)$.	Diff. of (9) from $\kappa\times(8)$.	p $s\times(3)$.	p $s\times(4)$.	Diff. (9) – (11).	Diff. (9) – (12).	Departures from Mean.		
															6	13	14
	4	28·565	26·33	26·39	13·35	– ·06	19·564	19·536	35·35	+0·02	35·35	35·43	0·00	–0·08	–8	–6	–5
	5	28·53	26·30	26·38	13·65	– ·08	19·572	19·533	35·36	+0·04	35·31	35·42	+0·05	–0·06	–6	–1	–7
	14	28·486	26·26	26·38	13·12	– ·12	19·546	..	35·31	..	35·26	35·42	+0·05	–0·11	–2	–1	–2
	16	28·04	25·83	25·95	12·70	– ·12	19·249	..	34·78	..	34·69	34·85	+0·09	–0·07	–2	+3	–6
	17	28·02	25·81	25·96	12·93	– ·15	19·227	..	34·74	..	34·67	34·86	+0·07	–0·12	+1	+1	–1
	18	28·46	26·23	26·37	12·43	– ·14	19·533	19·502	35·28	–0·02	35·22	35·41	+0·06	–0·13	0	0	0
	19	27·244	25·06	25·23	12·44	– ·17	18·723	18·656	33·83	+0·06	33·70	33·93	+0·13	–0·10	+3	+7	–3
	33	28·443	26·21	26·37	13·75	– ·16	19·528	..	35·28	..	35·20	35·41	+0·08	–0·13	+2	+2	0
	34	28·52	26·29	26·42	14·20	– ·13	19·547	..	35·32	..	35·30	35·47	+0·02	–0·15	–1	–4	+2
	41	28·425	26·19	26·41	14·78	– ·22	19·485	..	35·21	..	35·17	35·46	+0·04	–0·25	+8	–2	+12
	42	28·454	26·22	26·41	15·10	– ·19	19·522	19·476	35·27	+0·08	35·21	35·46	+0·06	–0·19	+5	0	+6
	43	28·335	26·12	26·26	14·96	– ·14	19·428	19·394	35·10	+0·06	35·08	35·26	+0·02	–0·16	0	–4	+3
Means	..	..	..	..	13·62	– ·14	..	..	..	..	..	..	+0·056	–0·129	3	3	4
	73	..	..	26·45	5·7	..	19·525	..	35·27	..	..	35·50	..	–0·23	..	..	+3
	74	..	25·75*	25·98	4·6	– ·23	19·170	..	34·63	..	34·61	34·89	+0·03	–0·26	..	..	+6
	75	..	..	26·48	5·0	..	19·558	..	35·34	..	..	35·54	..	–0·20	..	..	0
	76	28·49	26·27†	26·42	1·7	–·15	19·525	..	35·27	..	35·27	35·47	–0·01	–0·20	..	..	0
	77	..	..	26·43	4·3	..	19·602	..	35·41	..	..	35·48	..	–0·07	..	..	–13
	78	..	..	26·53	4·3	..	19·575	..	35·37	..	..	35·60	..	–0·23	..	..	+3
	79	..	..	25·17	4·8	..	18·593	..	33·60	..	..	33·84	..	–0·24	..	..	+4
	80	..	..	25·38	4·8	..	18·779	..	33·94	..	..	34·11	..	–0·17	..	..	–3
	81	..	..	25·00	5·4	..	18·477	..	33·41	..	..	33·62	..	–0·21	..	..	+1
	82	..	..	25·13	5·5	..	18·585	..	33·59	..	..	33·79	..	–0·20	..	..	0
	..	..	..	..	4·61	..	..	..	..	..	..	..	..	–0·20	..	..	3

* Sprengel determination made at 15°.

† Mean of Sprengel determinations at 0° and 15°.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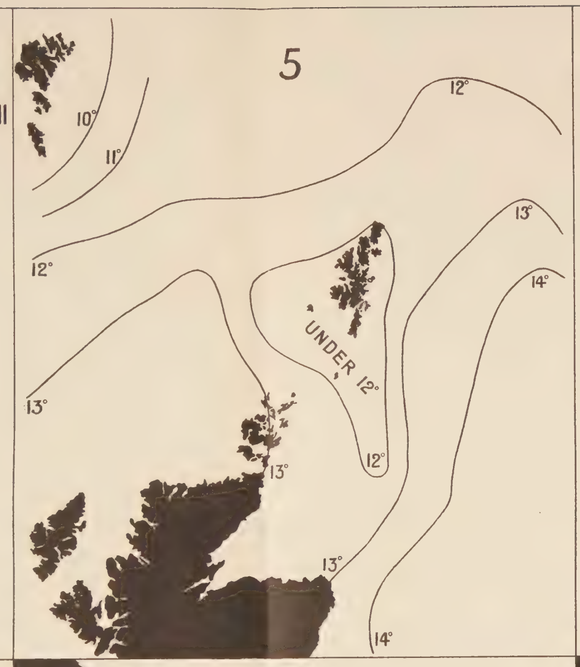
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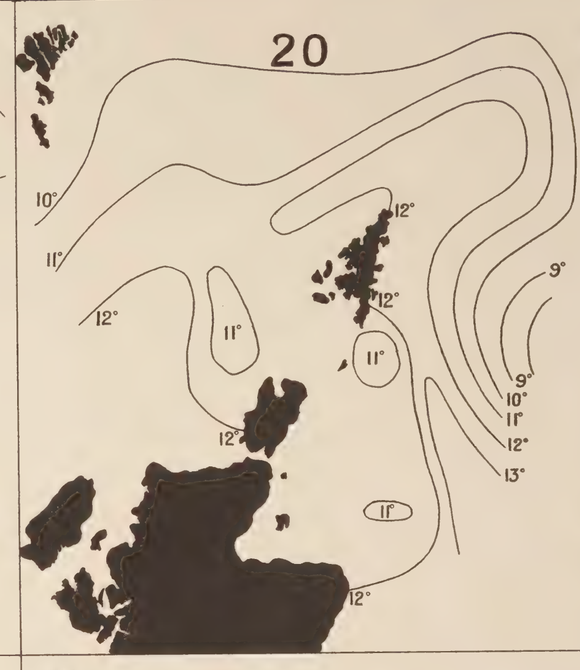
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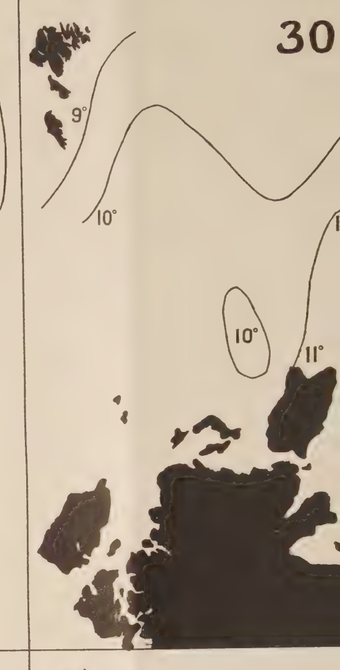
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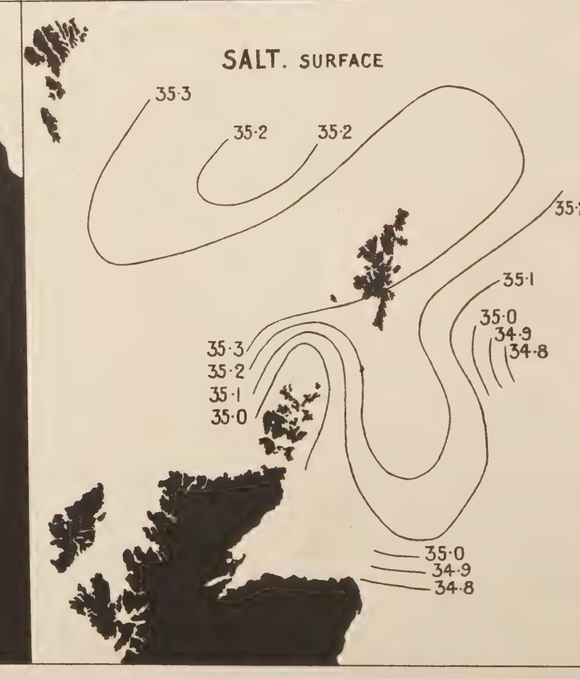
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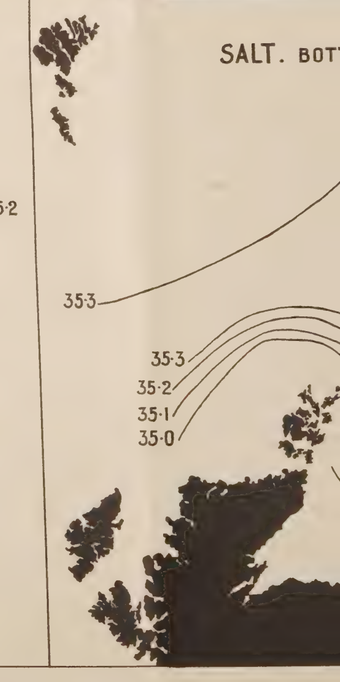
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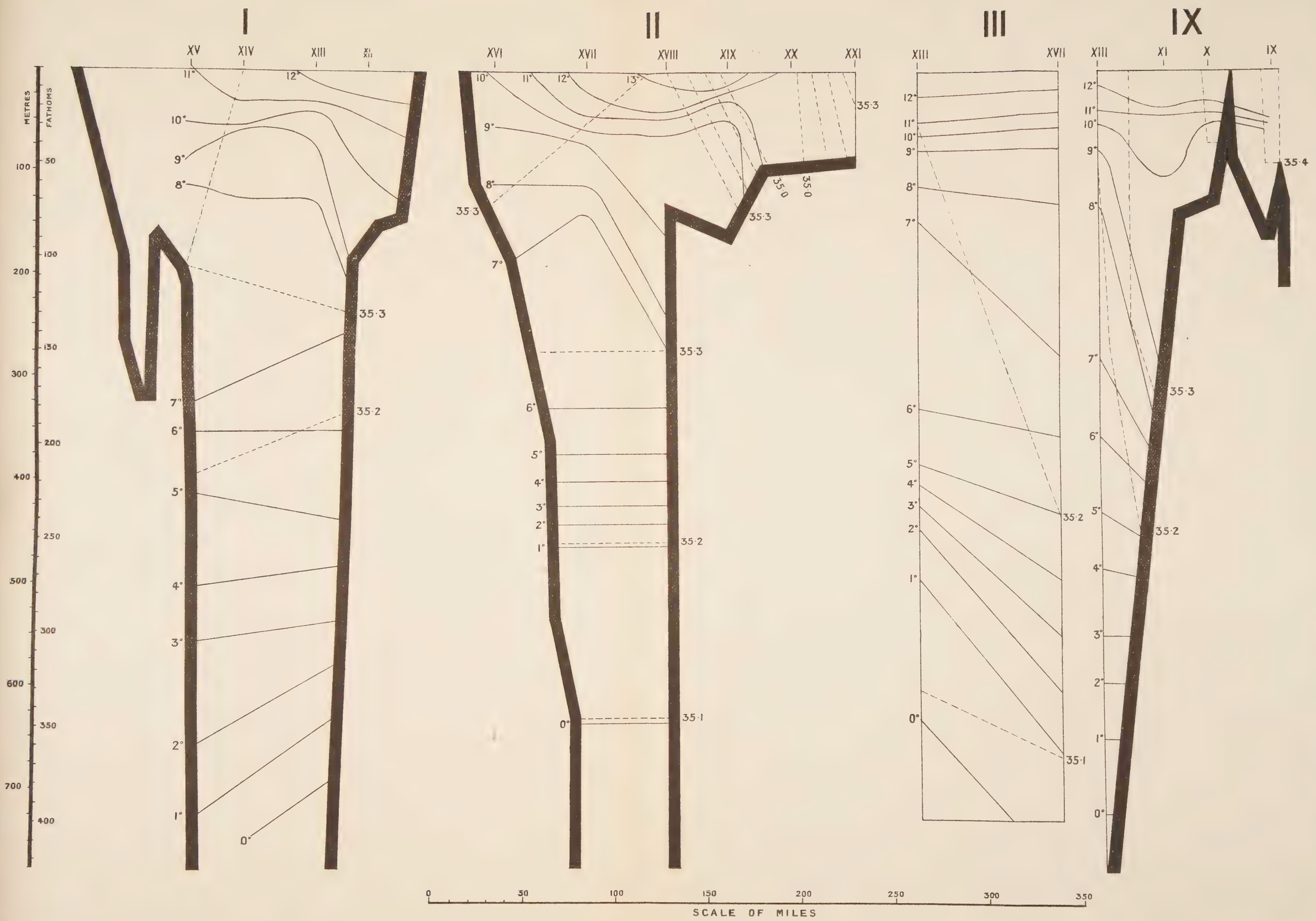
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XVII
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XI
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150
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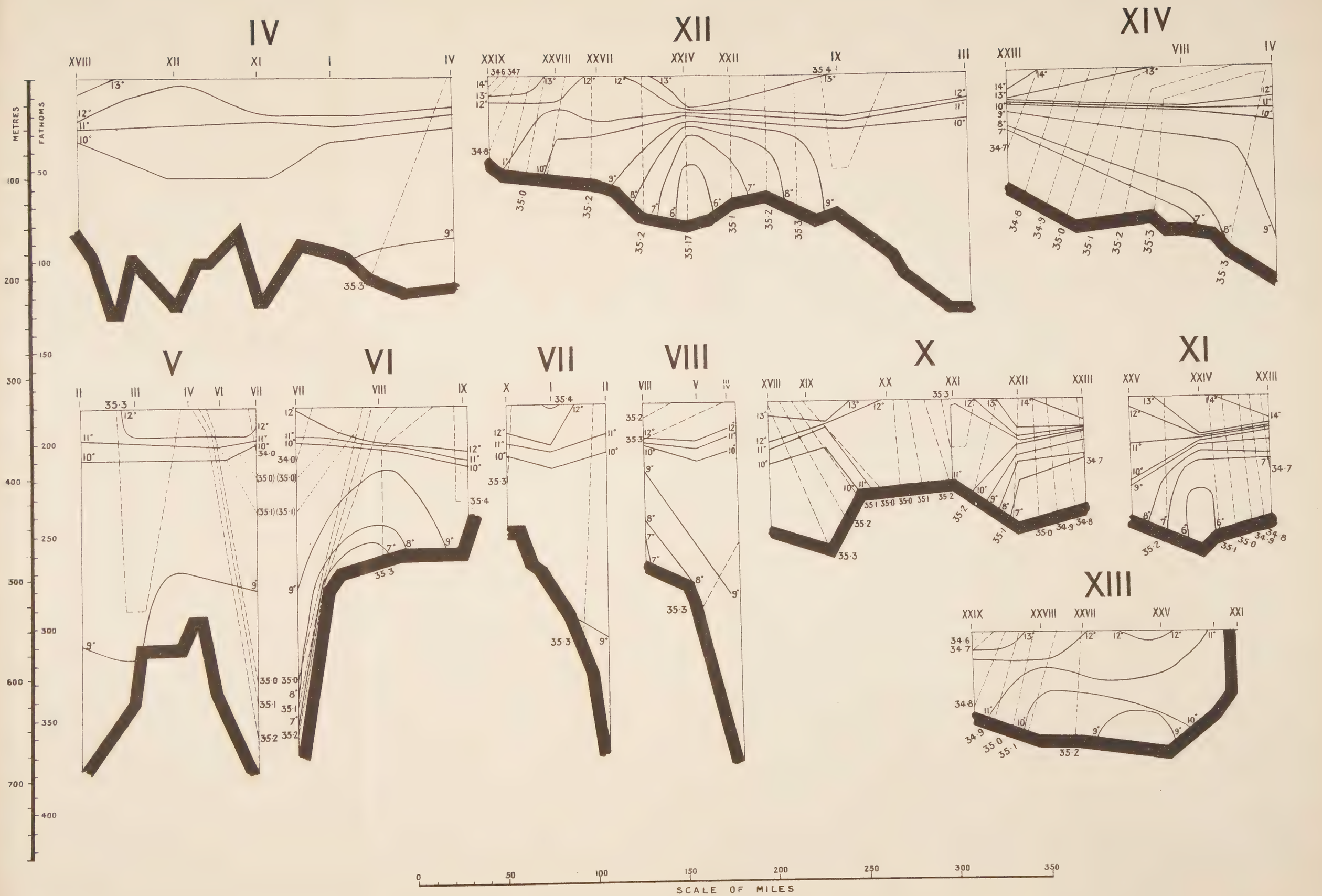
250
300
350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XVIII XIX XX XXI XXII XXIII
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XI
XXV XXIV XXIII
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XIII
XXIX XXVIII XXVII XXV XXI
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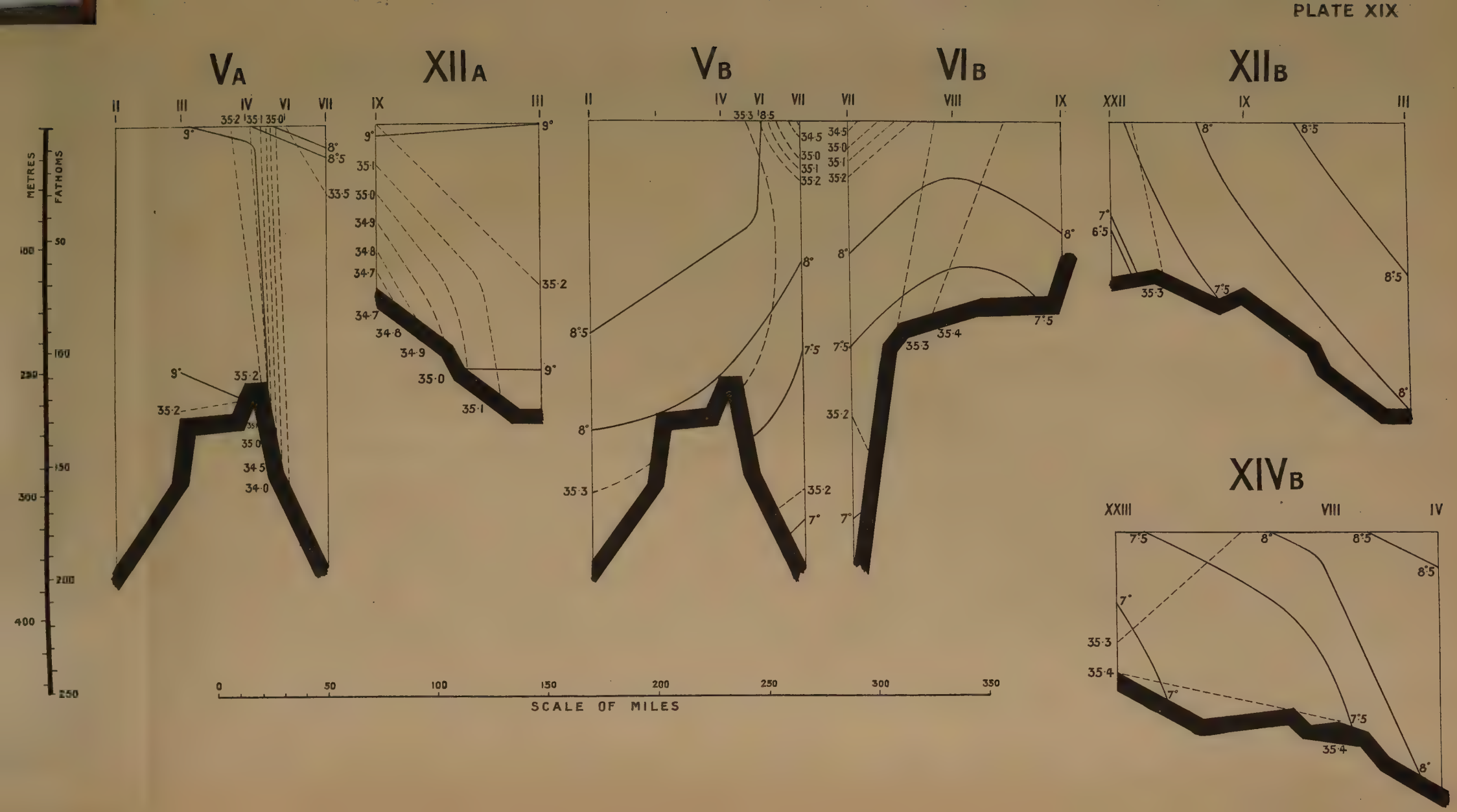
METRES
FATHOMS
0 50 100 150 200 250 300 350
SCALE OF MILES


VA
XIIA
VB
VIB
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METRES
FATHOMS
SCALE OF MILES
0
50
100
150
200
250
300
350

TABLE X.—Corrections for Reducing $_4S_t$ to $_4S_{15}$.

Computed from Krümmel's Tables.

$_4S_{15}$—1000 Salinity °/₀	15· 20·6	16· 21·9	17· 23·2	18· 24·5	19· 25·8	20· 27·1	21· 28·4	22· 29·7	23· 31·0	24· 32·3	25· 33·61	26· 34·91	27· 36·2	
$t°$	—	—	—	—	—	—	—	—	—	—	—	—	—	$t°$
0	1·57	1·61	1·65	1·70	1·73	1·79	1·85	1·91	1·96	2·01	2·05	2·09	2·13	0
1	1·53	1·57	1·60	1·65	1·68	1·73	1·78	1·83	1·87	1·92	1·97	2·01	2·05	1
2	1·50	1·53	1·56	1·60	1·63	1·68	1·73	1·78	1·82	1·86	1·90	1·94	1·98	2
3	1·45	1·48	1·52	1·56	1·59	1·63	1·67	1·71	1·74	1·78	1·82	1·85	1·88	3
4	1·41	1·44	1·47	1·51	1·54	1·58	1·61	1·64	1·66	1·69	1·72	1·75	1·78	4
5	1·35	1·36	1·39	1·42	1·44	1·48	1·51	1·54	1·56	1·58	1·61	1·64	1·67	5
6	1·27	1·28	1·30	1·32	1·34	1·37	1·40	1·43	1·45	1·47	1·50	1·53	1·56	6
7	1·17	1·18	1·21	1·25	1·27	1·29	1·31	1·33	1·35	1·36	1·38	1·40	1·42	7
8	1·07	1·08	1·10	1·12	1·13	1·14	1·16	1·18	1·20	1·21	1·23	1·25	1·27	8
9	0·95	0·96	0·97	0·99	1·00	1·01	1·02	1·04	1·06	1·07	1·09	1·11	1·13	9
10	0·82	0·83	0·84	0·85	0·85	0,86	0·87	0·88	0·90	0·91	0·93	0·95	0·97	10
11	0·68	0·69	0·70	0·71	0·71	0·72	0·73	0·74	0·74	0·74	0·76	0·78	0·80	11
12	0·53	0·53	0·54	0·55	0·55	0·56	0·57	0·58	0·58	0·59	0·60	0·61	0·62	12
13	0·36	0·36	0·36	0·37	0·37	0·38	0·38	0·39	0·39	0·40	0·41	0·42	0·43	13
14	0·19	0·19	0·19	0·19	0·19	0·19	0·20	0·20	0·20	0·20	0·21	0·21	0·21	14
15	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	15
	+	+	+	+	+	+	+	+	+	+	+	+	+	
16	0·17	0·18	0·19	0·20	0·21	0·21	0·21	0·21	0·22	0·22	0·22	0·22	0·23	16
17	0·39	0·40	0·41	0·42	0·43	0·43	0·43	0·43	0·44	0·44	0·44	0·44	0·45	17
18	0·61	0·62	0·63	0·64	0·66	0·66	0·66	0·67	0·68	0·68	0·68	0·68	0·69	18
19	0·84	0·85	0·86	0·87	0·89	0·89	0·89	0·89	0·90	0·90	0·90	0·90	0·91	19
20	1·06	1·07	1·08	1·09	1·10	1·11	1·12	1·13	1·15	1·16	1·17	1·18	1·19	20

TABLE XI.—To find the Salinity, the Value of χ being given.

χ	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
17·5	31·65	31·66	31·68	31·70	31·71	31·73	31·75	31·77	31·79	31·81
·6	·83	·85	·86	·88	·90	·92	·93	·95	·97	·99
·7	32·01	32·02	32·04	32·06	32·07	32·09	32·11	32·13	32·15	32·17
·8	·19	·21	·22	·24	·26	·28	·30	·31	·33	·35
·9	·37	·39	·40	·42	·44	·46	·48	·49	·51	·53
18·0	·54	·56	·58	·59	·61	·63	·64	·66	·68	·70
·1	·72	·73	·75	·77	·79	·80	·82	·84	·86	·88
·2	·90	·91	·93	·95	·97	·98	33·00	33·02	33·04	33·06
·3	33·08	33·10	33·11	33·13	33·15	33·17	·19	·20	·22	·24
·4	·26	·28	·30	·32	·34	·36	·37	·39	·41	·43
18·5	·44	·46	·48	·49	·51	·53	·55	·56	·58	·60
·6	·62	·64	·66	·67	·69	·71	·73	·75	·76	·78
·7	·80	·82	·83	·85	·87	·89	·90	·92	·94	·96
·8	·98	34·00	34·01	34·03	34·05	34·07	34·08	34·10	34·12	34·14
·9	34·16	·17	·19	·21	·23	·24	·26	·28	·30	·32
19·0	·33	·35	·37	·39	·40	·42	·44	·46	·47	·49
·1	·51	·53	·54	·56	·58	·60	·62	·63	·65	·67
·2	·69	·71	·72	·74	·76	·78	·80	·82	·84	·86
·3	·87	·89	·91	·93	·94	·96	·98	35·00	35·01	35·03
·4	35·05	35·07	35·08	35·10	35·12	35·14	35·15	·17	·19	·21
19·5	·23	·25	·27	·28	·30	·32	·34	·36	·38	·40
·6	·41	·43	·45	·47	·48	·50	·52	·54	·56	·58
·7	·59	·61	·63	·64	·66	·68	·70	·72	·73	·75
·8	·77	·79	·80	·82	·84	·86	·88	·89	·91	·93
·9	·95	·97	·98	36·00	36·02	36·04	36·05	36·07	36·09	36·11
20·0	36·12	36·14	36·16	·18	·19	·21	·23	·25	·27	·29
·1	·30	·31	·33	·35	·37	·39	·40	·42	·44	·46
·2	·48	·49	·51	·53	·55	·57	·58	·60	·62	·64
·3	·66	·68	·69	·71	·73	·75	·77	·78	·80	·82
·4	·84	·86	·87	·89	·91	·93	·94	·96	·98	37·00
·5	37·01	37·02	37·04	37·06	37·08	37·10	37·11	37·13	37·15	·17

TABLE XII.—To find Salinity, having given $_4S_{15}$.

$(_4S_{15}-1)$ ×1000	0	1	2	3	4	5	6	7	8	9
24·50	32·98	32·99	33·00	33·02	33·03	33·04	33·06	33·07	33·08	33·09
24·60	33·11	33·12	33·13	33·15	33·16	33·18	33·19	33·20	33·22	33·23
24·70	33·24	33·25	33·27	33·28	33·29	33·31	33·32	33·33	33·35	33·36
24·80	33·37	33·38	33·40	33·41	33·42	33·43	33·45	33·46	33·47	33·48
24·90	33·49	33·51	33·52	33·53	33·54	33·56	33·57	33·58	33·60	33·61
25·00	33·62	33·63	33·65	33·66	33·67	33·69	33·70	33·71	33·73	33·74
25·10	33·75	33·76	33·78	33·79	33·80	33·82	33·83	33·84	33·85	33·86
25·20	33·88	33·89	33·91	33·93	33·94	33·95	33·96	33·98	33·99	34·00
25·30	34·01	34·03	34·04	34·05	34·06	34·08	34·09	34·10	34·11	34·12
25·40	34·14	34·15	34·17	34·18	34·19	34·21	34·22	34·23	34·24	34·25
25·50	34·27	34·28	34·30	34·31	34·32	34·34	34·35	34·36	34·37	34·39
25·60	34·40	34·41	34·43	34·44	34·45	34·47	34·48	34·49	34·50	34·52
25·70	34·53	34·54	34·56	34·57	34·58	34·60	34·61	34·62	34·63	34·64
25·80	34·66	34·67	34·68	34·69	34·71	34·72	34·73	34·75	34·76	34·77
25·90	34·79	34·80	34·81	34·82	34·83	34·85	34·86	34·87	34·89	34·90
26·00	34·92	34·93	34·95	34·96	34·97	34·99	35·00	35·01	35·03	35·04
26·10	35·05	35·06	35·08	35·09	35·10	35·12	35·13	35·14	35·16	35·17
26·20	35·18	35·20	35·21	35·22	35·23	35·25	35·26	35·27	35·29	35·30
26·30	35·31	35·33	35·34	35·35	35·36	35·38	35·40	35·41	35·42	35·43
26·40	35·44	35·46	35·47	35·48	35·49	35·50	35·52	35·53	35·54	35·55
26·50	35·56	35·58	35·59	35·60	35·61	35·63	35·64	35·65	35·66	35·68

TABLE XIII.—Fathoms to Metres. 1 Fathom = 1·829 Metres.

Fathoms.	0	1	2	3	4	5	6	7	8	9
0	0	2	4	5	7	9	11	13	15	16
10	18	20	22	24	26	27	29	31	33	35
20	37	38	40	42	44	46	48	49	51	53
30	55	57	59	60	62	64	66	68	69	71
40	73	75	77	79	81	82	84	86	88	90
50	91	93	95	97	99	101	102	104	106	108
60	110	111	113	115	117	119	121	123	124	126
70	128	130	132	134	135	137	139	141	143	145
80	146	148	150	152	154	156	157	159	161	163
90	165	167	168	170	172	174	176	178	179	181
100	183	185	187	188	190	192	194	196	198	199
110	201	203	205	207	209	210	212	214	216	218
120	220	221	223	225	227	229	231	232	234	236
130	238	240	242	243	245	247	249	251	253	254
140	256	258	260	262	264	265	267	269	271	273
150	274	276	278	280	282	284	285	287	289	291
160	293	295	296	298	300	302	304	306	307	309
170	311	313	315	317	318	320	322	324	326	328
180	329	331	333	335	337	339	340	342	344	346
190	348	350	351	353	355	357	359	361	362	364
200	366	368	370	371	373	375	377	379	381	382
210	384	386	388	390	392	393	395	397	399	401
220	403	404	406	408	410	412	414	415	417	419
230	421	423	425	426	428	430	432	434	436	437
240	439	441	443	445	447	448	450	452	454	456
250	457	459	461	463	465	467	468	470	472	474
260	476	478	479	481	483	485	487	489	490	492
270	494	496	498	500	501	503	505	507	509	511
280	512	514	516	518	520	522	523	525	527	529
290	531	533	534	536	538	540	542	544	545	547
300	549	551	553	555	556	558	560	562	564	565
310	567	569	571	573	575	576	578	580	582	584
320	586	587	589	591	593	595	597	598	600	602
330	604	606	608	609	611	613	615	617	619	620
340	622	624	626	628	630	631	633	635	637	639
350	640	642	644	646	648	650	652	653	655	657
360	659	661	662	664	666	668	670	672	673	675
370	677	679	681	683	684	686	688	690	692	694
380	695	697	699	701	703	705	706	708	710	712
390	714	716	717	719	721	723	725	727	728	730
400	732	734	736	737	739	741	743	745	747	748
410	750	752	754	756	758	759	761	763	765	767
420	769	770	772	774	776	778	780	781	783	785
430	787	789	791	792	794	796	798	800	802	803
440	805	807	809	811	813	814	816	818	820	822
450	823	825	827	829	831	833	834	836	838	840
460	842	844	845	847	849	851	853	855	856	858
470	860	862	864	866	867	869	871	873	875	877
480	878	880	882	884	886	888	889	891	893	895
490	897	899	900	902	904	906	908	910	911	913
500	914	916	918	919	921	923	925	927	929	930
1000	1829									
1500	2743									
2000	3658									
2500	4572									
3000	5487									
3500	6401									
4000	7316									
4500	8230									

SECTION D.—CONTEMPORARY WORK.

AN ACCOUNT OF CONTEMPORARY SCIENTIFIC FISHERY WORK AND FISHERIES IN THIS AND OTHER COUNTRIES. By Dr T. Wemyss Fulton, F.R.S.E., Superintendent of Scientific Investigations.

In the following pages a summary is given of the information which has been made available respecting the sea fisheries in most of the countries of Europe and in America, and the various means employed for their regulation and improvement. This summary, as will be seen, is chiefly founded upon the official and other publications courteously sent by fishery and scientific authorities abroad.

In perusing these various reports and publications, one cannot fail to be impressed with the great and growing energy displayed by the various Governments and fishery departments in organising, regulating, and developing in every way possible the sea fisheries under their charge. The progress, indeed, which has occurred during the past five or six years is remarkable: Fishery Commissions and departments have been created where they did not previously exist; increasing activity is manifested in the collection and collation of statistics bearing upon the economic and scientific aspects of the fisheries; fishery schools have been established and competent instructors appointed to teach various branches of *technique;* scientific investigations are being prosecuted with great vigour, surveys of fishing grounds made, and marine laboratories multiplied; and the artificial propagation of the food-fishes and shell-fish carried on more extensively than before. During last year, at the various hatcheries throughout the world respecting which information has been received, close upon a thousand millions of the food-fishes were artificially propagated with the view of adding to the food-supply of the people.

Associated with this greater activity the appropriations made by various Governments for fisheries administration and management have been considerably increased. In the United States the central Fish Commission receives annually over £70,000, most of which is spent in the propagation of the food-fishes, and it has at its command two large steamers and a schooner. In Canada the money voted for fishery purposes last year was £108,000, and seven steamers and two sailing vessels are employed by the department.

I have to thank many foreign fishery authorities for assistance in this department; not merely in supplying reports and publications referring to their work, but in furnishing, promptly and readily, all information in their power on points submitted to them.

Among these I may mention M. Raveret-Wattel, Secretary to the Societé d'Acclimitation de France; Dr P. P. C. Hoek, Scientific Superintendent of Dutch Fisheries; Captain Drechsel, the Superintendent of Danish Fisheries, and the Naturalist, Dr Petersen; Professor Pouchet, the Director of the Concarneau Laboratory; Professor Marion, the Director of the Laboratoire d'Endoume, Marseille; Captain Dannevig, the Superintendent of the well-known hatchery at Flodevig; Señor Rafael Gutierren Vela, of the Spanish Fisheries Department; Sir Charles Tupper, the High Commissioner for Canada; Mr Nielsen, the Superintendent of the Newfoundland Fisheries; Professor Giglioli, of

Florence, Fishery Commissioner; His Highness Prince Albert of Monaco; Baron Jules de Guerne and M. Jules Richard; Drs Malm and Lundberg, the Inspectors of Swedish Fisheries; Dr Sauvage, Director of the Marine Station, Boulogne-sur-Mer. Among those at home who have been always willing to co-operate, I must mention the Inspectors of Irish Fisheries, and Professor M'Intosh, F.R.S.; Mr Ernest W. L. Holt; Mr Olsen, Secretary of the Grimsby Marine Fisheries Society; and Mr J. Wrench Towse, the Honorary Secretary to the National Sea Fisheries Protection Association. I have also to thank Mr. F. G. Binnie for assistance in the translation of some of the foreign reports.

1. UNITED KINGDOM.

The most noteworthy event in connection with the sea fisheries of this country, during 1893, was an inquiry held by a Select Committee of the House of Commons, which the Government appointed 'to consider the 'expediency of adopting measures for the preservation and improvement 'of the sea-fisheries in the seas around the British Islands, including the 'prohibition of the capture, landing, or sale of undersized sea fish, the 'prohibition of the sale or possession of certain sea fish during the period 'when their capture is forbidden, the fixing of close seasons, the prohibi-'tion or regulation of certain methods of fishing, the protection of defined 'areas, and other like regulations, international or otherwise.' The committee consisted of seventeen Members of Parliament, the Chairman being the Right Hon. E. Marjoribanks (now Lord Tweedmouth), and evidence was led at twenty-one meetings, held at Westminster. Witnesses were examined from various parts of the United Kingdom, and they included Mr Berrington, the Chief Inspector of the Fisheries of England and Wales; Mr Esslemont, the Chairman and Professor W. C. M'Intosh, the scientific member of the Scottish Fishery Board; Mr W. S. Green, Inspector of Irish Fisheries; Professor Ray Lankester, Professor Herdman, Dr. Günther, Messrs Holt, Cunningham, Calderwood, and others, as well as representatives of the fishing industry and of fishery associations. In their Report * the committee state that they have had the advantage over any previous fishery inquiry, in the fact that they have had before them the statistics which have of recent years been collected by the Board of Trade and the Fishery Board for Scotland, and the evidence founded on scientific observations. It is pointed out that 'the comparative success of our fisheries 'in any given place, or in any given year, depends so much on conditions 'of weather and of atmosphere, on the movements or migrations of fishes, 'and the supply of the natural food of the various kinds of fishes, that 'it is very difficult, except after a careful and complete examination of 'the circumstances under which the fisheries have been conducted for a 'number of years, to arrive at any true conclusion as to the reasons of 'their comparative success or failure in any given year, or whether there 'has been any real falling off in the fish supply in a particular district, or 'what the reasons for such a falling off may be, if it has occurred.' The committee, as a result of their inquiry, found that no falling off had occurred in the herring fisheries, or in the fisheries for round fishes, as cod and haddocks, although local scarcities in the latter group, are said to have been caused by the operations of trawlers. On the other hand, it was found that, respecting the great fishing grounds of the North Sea, the consensus of evidence of 'all persons interested in the fisheries, whether 'trawlers or linesmen, whether smack owners or fishermen, whether

* *Report from the Select Committee on Sea Fisheries, together with the Proceedings of the Committee, Minutes of Evidence, Appendix and Index.* London, 1893.

'scientific experts or statisticians,' showed that among the more valuable classes of flat-fish, especially among soles and plaice, considerable diminution had occurred, and that this diminution was to be attributed to overfishing by trawlers in certain localities. The principal remedy, suggested by nearly all the witnesses, was the enactment of a law forbidding the landing and sale of flat-fish below a certain limit of size; the chief reason given for this recommendation being that, by the enforcement of a size limit in this way, trawlers would avoid those grounds on which small fish are mostly captured, since it would be impossible to sell them. Two limits of size were suggested:—(1) by the National Sea Fisheries Protection Association, viz., 12 inches for turbot and brill, 11 inches for lemon soles, 10 inches for plaice and soles; (2) by the experts of the Marine Biological Association, founded on the sizes at which the various fishes come to sexual maturity, which are in the North Sea, 17 inches for plaice, 12 inches for soles, 18 inches for turbot, 15 inches for brill, and 12 inches for lemon-soles. The committee were, however, of opinion that the sizes in both cases were too large, and would involve great hardship to many of the poorer fishermen, who fish near the shore in small boats; they recommended a limit of 8 inches in extreme length for soles and plaice, and 10 inches for turbot and brill, and further, 'that a strong effort 'should be made to secure the adoption of uniform regulations for limits 'of size and other matters by all the nations interested in the North Sea 'Fisheries.'

The committee further recommended a very important alteration in the boundaries of the territorial waters. They express the opinion 'that 'the best method for effectively governing the operations of the various 'classes of fishermen, and, at the same time, for securing, so far as it may 'be found possible, the proper protection of spawning and immature fish, 'would be to throw the responsibility of these duties, so far as the waters 'immediately adjacent to the various countries are concerned, on those 'various countries; that, for the effective realisation of this object, the 'present territorial limit of 3 miles is insufficient, and that, for fishery 'purposes alone, this limit should be extended, provided such extension 'can be effected upon an international basis, and with due regard to the 'rights and interests of all nations.' They, accordingly, 'earnestly 'recommend that a proposition on these lines should be submitted to 'an international conference of the powers who border on the North Sea.' Respecting the administration of the fisheries in this country, the committee recommended that in England a direct representative element should be introduced into the existing district sea fishery committees, and that an English Sea Fishery Board should be established, in its turn largely representative of the district committees; and that in Scotland similar district committees should be formed, and the Central Fishery Board made largely representative of them. To these authorities the committee would entrust 'jointly, the care and regulation of all British 'sea fisheries, and would recommend that they should be supplied with 'adequate funds to collect statistics, to carry on the necessary scientific 'observations and investigations, and to keep up an efficient sea police to 'enforce the regulations made by them.'

They further recommend that the fishery authorities should be provided with a number of fast steam-vessels of a class similar to the newest examples of steam-trawlers, for police work and scientific observations and experiments.

The Report also deals with the question of a close time for herrings, English oyster-beds, and harbour accommodation.

The scientific fishery investigations of the Marine Biological Association, during 1893, were carried on as before, partly at the Plymouth Laboratory,

and partly at Cleethorpes, near Grimsby. Mr Ernest W. L. Holt gives some of the results of his further inquiries on the destruction of immature fish in the North Sea.* They refer chiefly to the number of boxes of large specimens and the number of boxes of small specimens of various fishes landed at Grimsby. Respecting plaice, the number of boxes landed in the five months, April to August (exclusive of six days, when the numbers were not obtained), was 94,069. Of these 63,505 were caught in the North Sea, and 30,564 were caught at Iceland. The Iceland fish were all 'large'; but of the boxes from the North Sea only 43,529 contained 'large,' the remaining 19,726 boxes containing 'small' plaice. Most of the small fish were caught on the eastern grounds. Holt found, in May, that the large boxes contained, on an average, 100 fish, of which 40 were under the biological standard of maturity. The adult fish landed in this month therefore numbered about 451,920, while the immature numbered about 2,212,280, 301,280 being among the 'large,' and the rest comprised the 'small,' of which about 250 go to a box.

In a paper on the 'Ovaries of Fishes,' Mr J. T. Cunningham describes his investigations into the development of eggs in the ovary of some flat-fishes, and the history of the ovary before and after maturity is attained, the special object being to trace the history of the ovary from one spawning period to the next. The observations were made on the ovaries of plaice, dabs, flounders, soles, turbot, and brill. In the plaice the spent ovary, so far as the microscopic appearance of the germinal tissue is concerned, may be quite similar to an immature ovary. Mr Cunningham thinks it is certain that all the yolked ova left in an ovary after spawning has taken place, degenerate and disappear, and that the formation of yolk in the succeeding crops of ova does not commence till some time after spawning is over. The number of yolkless eggs left in the ovary after spawning is far less than the number of ripe eggs shed in the following season. Consequently, the greater number of the eggs of one season's crop are produced *ab initio* during the year. In the sole this does not appear to be the case; the maturation of one crop of ova seems to begin before the preceding crop has been shed. In regard to this species, however, Mr Cunningham thinks a more complete study is necessary.

In another paper Mr Cunningham states that he has been able to add to his previous observations on the reproduction and development of the pilchard. He was able, for the first time, to obtain artificially fertilised eggs, to hatch the larvæ, and to rear them for several days. These are described and figured.

The report on the sea fisheries of England and Wales, in 1892, contains a great deal of interesting matter.† The returns of fish, other than shell-fish, landed in England and Wales in the year referred to, show a quantity of 324,000 tons, as compared with 298,000 tons in 1891, with a value of £4,629,000, as against £4,491,000. Among the principal changes the take of soles and plaice has decreased, while that of herrings and haddocks has increased. The value of shell-fish fell from £380,000 in 1891 to £354,000 in 1892. It is difficult, owing to the imperfect nature of the information, to give the total numbers of boats and men actually engaged in sea fishing; the number of fishing-boats registered was 8063; but there are numerous exceptions to the rules requiring registration.

An account is given of the scientific fishery investigations prosecuted by the Lancashire Sea Fisheries Committee during the year, in their

* *Journal of the Marine Biological Association*, New Ser., Vol. III., No. 2, 1894, p. 123.

† *Sea Fisheries* (*England and Wales*) *Seventh Annual Reports of the Inspectors* (for 1892). London, 1893.

Annual Report.* Investigations have been continued on the food of the various edible fishes, their maturity in relation to their size in the Lancashire district, the vitality of those caught by various nets, the position and physical conditions of the spawning grounds, &c. One of the objects is to ascertain what the fish feed upon in the district at all stages of their lives. It is pointed out that, by determining the food of the young forms, it will be possible to arrange for a supply of suitable food for the rearing of fish fry hatched artificially through the earlier and more critical stages of their life-history. At Port Erin Biological Station successful experiments have been made in breeding Copepoda in tanks. Enormous swarms of *Idya furcata* and *Harpacticus fulvus* have been produced; and the important observation has been made that these forms, which are the most easily reproduced, constitute by far the most important food of young plaice. Many tables are given, showing the results of the examination of the stomachs of young fish, especially plaice. Of 893 young plaice (from $\frac{1}{8}$ of an inch to 3 inches) 547 had crustacea in their stomach, 134 had mollusca (chiefly *Cardium*, *Tellina*), 128 animal tissue (undistinguishable), and 182 were empty. Of the 547 with crustacea, 296 had Copepoda. Young dabs (*P. limanda*) had chiefly mollusca (*Scrobicularia*, *Mytilus*, *Mactra*). During the year 4326 stomachs of marine animals were examined. It appears that young plaice, about an inch long, live mainly on Copepoda, small Cumacea and some crustacean larval forms, while afterwards, when they are about $1\frac{3}{4}$ inches long, they take to a more mixed diet, consisting largely of mollusca and worms. Cod, from 3 to 9 inches in length, feed chiefly upon crustacea, such as *Crangon*, *Mysis*, and Amphipoda. As they get larger they take to eating fish, such as smaller cod, whitings, sprats, &c., and large crustacea. Young whitings also live largely upon crustacea. The committee's steamer, the 'John Fell,' was engaged in investigating the offshore spawning grounds. A number of experiments on the vitality of fishes, caught in the trawl, were made, similar to those previously carried out on the 'Garland,' and with similar results.† In the case of the sole 61 specimens were obtained in 19 hauls, lasting from 45 to 165 minutes; the fish ranged from 3 to 15 inches, and only three, or 5 per cent., were dead.‡

Professor Herdman, in a very interesting report in the Appendix, describes the methods of oyster and mussel culture on the west coast of France, which he visited last year, in accordance with the wish of the Lancashire Sea Fisheries Committee. The part of the coast visited was between Arcachon and Brittany. At Arcachon 12,000 of the 30,000 inhabitants are employed constantly in the oyster parcs, and about 300,000,000 oysters are here produced annually, their value being upwards of 1,000,000 francs. The mode in which the spat is collected is described; last year the spatting was very successful. Professor Herdman found the temperature of the water (July 3rd) in the middle of

* *Report for* 1893 *on the Lancashire Sea-Fisheries Laboratory.* By Professor W. A. Herdman, D.Sc., F.R.S. Liverpool, 1894.

† *Ninth Annual Report*, Part III., p. 202, 1891.

‡ The value of such experiments, as Professor Herdman points out, should be great, in relation to any measures taken to compel shrimp-fishermen to return to the sea the small flat-fish they capture. But that the figures just quoted respecting the sole will not apply to this fish, as caught by the great trawlers in the North Sea, is made evident on page 205 of the present Report. It is there shown that, of several hundreds obtained after long drags of the trawl and at once transferred to tubs of sea-water, through which a continuous circulation was maintained, not one could be maintained in life. Mr Liston, who had charge of the experiments, has had many years' experience of similar work as mate of the 'Garland,' and he did everything possible to keep them alive. It is pretty obvious that immature soles, at least, if returned to the sea in such cases, would perish.

the 'Bassin d'Arcachon' to be 76° F., and the specific gravity 1·024, while over the shallow oyster parcs the temperature varied from 78° F. to 80° F., and the specific gravity from 1·022 to 1·024. In one or two corners of the parcs at low tide, where the last of the ebb had been exposed to the mid-day sun, the temperature rose as high as nearly 90° F. The cultivators at Arcachon attach great importance to the high temperature. An account of the system of oyster culture is given; concessions of ground for parcs are granted by the State, at a rent of about 10s. per acre. The system of bouchot mussel-culture in use at Aiguillon is described, and also the method of catching shrimps in traps at Le Croisic.

The Annual Report on the Fisheries of Ireland contains, as usual, a large amount of interesting information.* The number of vessels and boats actually employed in fishing last year was 6579, an increase of 208 on 1892, and 24,001 men and 1215 boys were engaged—an increase over the previous year of 730 and 244 respectively. Eleven Irish boats (from Arklow) attended the Scotch herring fishing.

Complete fishery statistics are not yet collected in Ireland, but, according to the returns received by the inspectors from the places where statistics have been kept, the total quantity of fish (excluding shell-fish) captured in 1893 was 780,965 cwts., valued at £298,518. In 1892 the corresponding figures were 606,426 cwts., and £270,662. The total is made up as follows:—Turbot, 1465 cwts. (£5210); soles, 2719 cwts. (£9117); mackerel, 467,560 cwts. (£152,512); herrings, 105,606 cwts. (£30,952); cod, 41,664 cwts. (£18,873); ling, 17,775 cwts. (£7603); hake, 38,973 cwts. (£15,508); haddock, 22,104 cwts. (£14,401); whiting, 16,891 cwts. (£7634); sprats, 1914 cwts. (£212); all others (except shell-fish), 64,287 cwts. (£28,496). As compared with 1892 there was a slight increase in the quantity of turbot (44 cwts.), and a considerable increase in the value, viz., by £799; a falling off in soles to the extent of 3859 cwts., a considerable increase in mackerel, and a slight increase in herrings. More than half the mackerel were caught on the south coast, and nearly all the rest on the west coast. The value of shell-fish landed was £55,990, of which lobsters contributed £31,850, oysters £6770, crabs £4000, and cockles, periwinkles, mussels, &c., the balance of £14,170. Loans, to the extent of £2516, 4s., were granted among 153 persons for purchase or repairs of fishing-boats and gear.

The spring mackerel-fishing was exceptionally successful on the west coast, but not fortunate on the south coast; 37 English, 9 Scotch, 230 Manx, 93 French, and 1042 Irish boats were employed (809 of the latter being third-class boats and curraghs). The number of boxes caught was 234,862 (or about 14,091,720 mackerel), valued at £105,649, or an average of about 9s. a box. The autumn fishing is principally prosecuted on the south-west coast, and most of the mackerel are cured for the American market. In 1893, no less than 51,252 barrels of Irish mackerel were thus cured, compared with 18,400 barrels in the previous year. Many thousands of the coast people, male and female, earn considerable sums by cleaning and pickling the fish. Beam-trawling is not very largely made use of by Irish fishermen, about 218 vessels, almost all sailing and mostly small, being engaged in it. The inspectors point out that the trawling question is quite different in Ireland from what it is in England and Scotland, where large and powerful steam-vessels are employed; and that any suggestion of a restrictive character should, at least, be supported by scientific evidence of its necessity, or by the absolute necessity of harmonising local interests in a fair manner, and of pro-

* *Report of the Inspectors of Irish Fisheries on the Sea and Inland Fisheries of Ireland*, for 1893. Dublin, 1894.

tecting fishing gear. Various bye-laws regulate this mode of fishing at different parts of the coast—most of them relating to the visits of steam-trawlers.

Last year a great amount of fishery work of a practical kind was accomplished in Ireland by the aid of the Congested Districts Board.* The Sea and Coast Fisheries Fund, transferred to the Board on their creation, was as follows:—Securities, £2189, 19s. 3d.; cash, £4115, 1s. 8d.; estimated value of outstanding loans, £11,958,—or a total of £18,263, 0s. 11d. This loan fund, with the Reproductive Loan Fund (amounting to £69,004, 13s. 3d.), was placed at the disposal of the Board for the general purpose of providing for the improvement of congested districts in Ireland, in terms of the Act of 1891. The estimate of the expenditure of the income of the Board in 1893–94, as approved by the Treasury, is as follows:—

Agriculture,	£15,900	0	0
Fisheries,	11,000	0	0
Industries,	3,500	0	0
Piers, Roads, Bridges, &c.,	14,418	7	8
Local Inquiries and Inspections,	2,450	0	0
	£47,268	7	8

The operations of the Board, in connection with the promotion of sea fisheries, was directed along the north-west, west, and south-west coasts towards the development of both the fresh-fish and cured-fish trade; co-operation having been secured with railway companies. In 1892, after unsuccessful attempts to induce large fishing firms to try mackerel fishing at the Arran Islands, a bounty of £40 was paid to County Wicklow boats to undertake the risk, and they were so successful that the boats returned next year without a bounty being given, and the native fishermen took part in it. The Arran mackerel fishing lasted, in 1893, from 4th April to 8th June, and during this time twenty-three boats were engaged in supplying fish to the Board's commission agent; each boat earned an average of £120 (from £14, 12s. 14d. to £304, 9s. 10d). The Board also opened a number of fish-curing stations in the counties Donegal, Mayo and Galway, and bought the fish from the fishermen at certain rates, selling the cured fish for the best price they would bring. These stations were managed directly by the Board with the assistance of Shetland and Scotch fish-curers. It is anticipated that during the present year (1894) at least seventeen stations will be actively worked by or in conjunction with the Board, for the curing of cod, ling and saithe. Mackerel and herrings were also purchased and cured by the Board. The Board in connection with their operations continued to charter the steamer 'Fingal,' which has been incessantly employed in the carriage of fish, salt, and other requisites, and also in the inspection of the various fishing stations, and proposed sites for piers, &c. In different localities instructions have been given in net-mending, and children are being instructed in the art. Instruction is also given in the management of boats, line-fishing, fish-curing, &c. The object of the Board is not to provide anything in the nature of 'relief;' but to stimulate the various branches of the fish industry on commercial principles, so that they may be able ultimately to exist independently. The loans made out of the funds are secured either by mortgages on boats and by promissory notes given by the borrowers and their sureties, or, in the case of small loans, by promissory notes only.

* *Second Annual Report of the Congested Districts Board for Ireland*, for the year ended the 31st of December 1893. Dublin, 1893.

In a few exceptional cases fishing gear has been given on condition that, in payment thereof, a percentage of the fish should be retained by the agent.

The results of an inquiry, held by the Inspectors of Irish Fisheries into the mackerel and herring fisheries off the south-west coast of Ireland were recently published.* The question closely concerned certain Scottish herring fishermen, particularly of Cockenzie, in the Firth of Forth, and the inquiries were made partly in Scotland, partly in Ireland, partly in England, and the Isle of Man. The inspectors recommend that a close season for herrings should be established off the coast of the county of Cork, from Poor Head to Mizen Head, from the 1st of April to the 16th of May in each year, and that it should be illegal to possess or deal in herrings captured within these limits of place and time.

2. CANADA.

The value of the Canadian fisheries in 1893 amounted to the large sum of 20,686,660 dollars, beside the estimated value of the fish consumed by Indians, and not included in the returns, which is supposed to be 3,000,000 dollars. The total value thus shows an increase of 1,500,000 dollars over 1892.† The amount of money voted for the administration of the fisheries during the year was 526,282 dollars—or about £108,000—of which 486,796 dollars was expended. The amount voted for fish-culture was 48,000 dollars; for fisheries service, 104,900 dollars; for fisheries protection service, 109,422 dollars; and for fishing bounties, 160,000 dollars. The Dominion Government maintains 7 steam-vessels and 2 schooners for the superintendence of the fisheries. The revenue derived from the fisheries —from rents, license-fees, and fines, amounted to 111,540 dollars. Thirteen fish-hatcheries for the artificial propagation of the food-fishes were maintained in operation.

The value of the fisheries, as has been said, was 20,686,660 dollars; to this total Nova Scotia contributed 6,407,279 dollars; British Columbia, 4,443,963 dollars; New Brunswick, 3,746,121 dollars; Quebec, 2,218,905 dollars; Ontario, 1,694,930 dollars; Prince Edward Island, 1,133,368 dollars; Manitoba and the North-West Territory, 1,042,093 dollars. The increase over 1892 was entirely due to the enormous catch of salmon in British Columbia. Among the food-fishes of the Dominion, the cod, as usual, heads the list. The value of the catch in 1893 was 4,028,448 dollars. Then comes salmon with a total of 3,890,644 dollars, an increase of 1,647,797 dollars over the previous year. The lobster takes the third place, with a total value of 2,484,568 dollars; then follow the herring, with 1,852,891 dollars to its credit, and in succession white-fish (*Coregonus*), with 1,298,744 dollars; mackerel, 1,096,066 dollars; seals, 874,842 dollars; trout, 658,614 dollars; haddock, 446,320 dollars; smelts, 414,174 dollars, &c. The value of halibut was 215,367 dollars; oysters, 156,440 dollars; eels, 118,793 dollars; sturgeon, 105,795 dollars; squid, 43,744 dollars. The most striking fluctuation in these figures, when compared with those of the previous year, is the great increase of over a million and a half of dollars in the yield of salmon in British Columbia, where the unprecedented number of twenty-nine million 1-lb. tins were packed. The sealing industry fared better than in 1892, show-

* *Report of the Inspectors of Irish Fisheries on the allegation that the custom of fishing for herrings off the south-west coast of Ireland before the 1st of June in each year is detrimental to the Mackerel and Hake Fisheries.* Dublin, 1894.

† *Twenty-Sixth Annual Report of the Department of Marine Fisheries,* 1893. Ottawa, 1894.

ing an increase in value of nearly a quarter of a million of dollars. The British Columbian fleet captured about 24,000 fur seals more than in 1892. Notwithstanding the enormous drain of the past fifteen years on the lobster supply, an increase of nearly half a million dollars is returned over the value in the previous year. The increase is general in all the maritime provinces, but it was most marked in Nova Scotia. About 88,000,000 lobsters were captured during the season to fill the 13,674,713 cans put up at the factories, besides 7,347 tons shipped fresh or alive. On the other hand, the catch of mackerel continued to diminish. In 1892 the value of the mackerel landed was more than half a million dollars less than in 1891, while in 1893 there was a further decline to the extent of a quarter of a million dollars. The quantity of fish-oil obtained was 804,820 gallons, valued at 321,927 dollars; and the value of fish used as bait was nearly 300,000 dollars.

The number of men engaged in fishing in Canada last year was 67,750, and the fishing gear represents a capital of 8,681,557 dollars permanently invested. There were 1,104 fishing vessels, of an aggregate tonnage of 40,096, manned by 8,899 sailors. The other fishermen number 58,850, who use 31,508 boats, and 5,406,800 fathoms of gill-nets and seine-nets, which are valued at over a million and a half dollars. Compared with the figures for 1892, there is shown an increase of about 100 vessels, 1000 boats, and 3000 men engaged in fishing.

These figures show the great importance of the fisheries among the industries of Canada. A special feature in the administration is the bounty-system, under the authority of an Act of 1891, to encourage the development of the sea fisheries and the building of fishing-vessels, and which provides for an annual expenditure for these purposes of 160,000 dollars, according to certain regulations. The total number of claims received during the year 1892 was 14,829, and the number paid was 14,442. The amount actually expended on bounties, on the basis of 3 dollars per ton to vessels, and 3 dollars per man to boat-fishermen, and 1 dollar per boat to the owners, was 159,754 dollars. Bounty was paid to 668 vessels, 13,744 boats, and 29,064 fishermen. For the purpose of developing the oyster fisheries the Government wisely obtained the services of two experts, who possessed a thorough practical knowledge of the questions with which they had to deal, Messrs F. and E. Kemp, from the Whitstable Oyster Company. These gentlemen made a careful examination of a number of important oyster-beds at various parts of the coast, and have, as a result, made various recommendations, and drawn up regulations for the preservation and development of the oyster fisheries. Active measures have been taken under their guidance in cleaning the beds and replanting the oysters, and it is anticipated the benefits will be considerable. An account is given of two methods of fish-drying, one by pressure and the other by heat. As in the United States considerable attention is being given in Canada to the fisheries in the great lakes—Lake Superior, Luke Huron, Lake Erie, and Lake Ontario. These lakes are of immense size—some are about 400 miles long—possessing an area of over 72,000 square miles. On one side the fisheries, broadly speaking, belong to the United States, and are possessed by the citizens of the Republic; on the other side they belong to Canada, and are carried on by Canadians. The regulations in the two countries by no means correspond, and the Canadian fishermen complain of the severity of the restrictions, or proposed restrictions, on their operations. An International Commission has been appointed in connection with these fisheries, which are the most extensive lake fisheries in the world. In 1892 there were 77 steam-tugs and schooners, and 1,032 sailing-boats, manned by 2,700 men, employed in fishing on the great lakes; over a million fathoms

of gill-net and seines and 368 pound-nets were used, representing invested capital to the amount of about 700,000 dollars, and the value of the fish caught was nearly 2,000,000 dollars. During the ten years, 1883 to 1892, the total quantity of fish caught in these lakes was 239,470,000 lbs., valued at 14,258,510 dollars; the fish are chiefly 'herrings,' white-fish (*Coregonus*), salmon-trout, pickerel, sturgeon, and bass. By far the most important is Lake Huron, which, in the period mentioned, yielded fish valued at 7,768,728 dollars, or more than the combined total from the other three lakes. It is claimed, and on very good grounds, that the restrictions and regulations enforced in the Canadian waters have benefited the fishermen of the Dominion much more than the free and unrestricted fishing in the waters of the United States have benefited the fishermen of that country. The fisheries on the Canadian side are not depleted to anything like the same extent as they are on the States' side, as is well shown in a series of tables giving the relative catches in 1885 and 1889, two years for which statistics are available for both sides. On the Canadian side, the tables shows an increase in all the lakes, from 27 per cent. in Lake Huron to 100 per cent. in Lake Erie; on the United States side there is an increase of 34 per cent. in Lake Huron, and a decrease in the other three, varying from 3 to 10 per cent. Partly in connection with these questions of the lake fisheries, a Commission, consisting of Mr R. Rathbun, of the United States Fish Commission, and Dr W. Wakeham, Inspector for the Gulf Division of Canadian Fisheries, was appointed in 1892 by the respective Governments to consider and report concerning the regulations, practice, and restrictions proper to be adopted in concert on the following subjects:—(1) The limitation or prevention of exhaustive or destructive methods of taking fish and shell-fish in the territorial and contiguous waters of the United States and her Majesty's possessions in North America respectively, and also in the waters of the open seas outside the territorial limits of either country to which the inhabitants of the respective countries may habitually resort for the purpose of such fishing. (2) The prevention of the polluting or obstructing of such contiguous waters to the detriment of the fisheries or of navigation. (3) The close seasons expedient to be enforced and observed in such contiguous waters by the inhabitants of both countries as respects the taking of the several kinds of fish and shell-fish. (4) The adoption of practical methods of restocking and replenishing such contiguous and territorial waters with fish and shell-fish, and the means by which such fish-life may be therein preserved and increased. The inquiry began on the Atlantic coast on 1st June, and was continued along the shores of Lakes Ontario and Erie, and later at Gloucester, Mass., in connection with the mackerel fishery. The report contains two special reports by Professor Prince, Commissioner of Fisheries, one dealing with the injurious use of seines in inland waters, and the other with the need of a marine scientific station for Canada. It is, indeed, a surprising fact that Canada, which possesses fisheries so great and valuable, and so many fishery laws and regulations, should be exceptional in this respect.

At the various hatcheries the gross number of fry produced was 258,314,000. The number of the fry of the white-fish (*Coregonus*) put out was 86,360,000; Atlantic salmon, 5,513,000; Pacific salmon, Sockeyed (*Naka*), 5,764,000; salmon trout, 6,652,000; speckled trout 425,000, and lobster, 153,600,000. The lobsters were all hatched at the Marine Hatchery at Bay View, referred to in previous reports, the eggs being obtained from the canning factories in the neighbourhood. About 75 per cent. of those obtained were hatched and the fry released in the waters in the vicinity.

3. NEW SOUTH WALES.

The report of the Commissioners of Fisheries, for the year 1892, contains interesting information on the sea fisheries of the colony. The yield of oysters has increased by 2701 bags over that of the previous year, totalling 7428 bags; besides this, 12,751 bags were imported from other colonies, principally from New Zealand. The application for leases of foreshore for oyster culture embrace a total of only 3550 yards, being 2975 yards less than were applied for in 1891. The decrease is attributed to the uncertainty which has attended previous efforts at oyster-farming, owing to the prevalence of the worm-disease, and the defective nature of the legislation which governs the industry. Trout ova, to the number of 34,000, were received from New Zealand, and the fry placed in various streams. The amount realised for the sale of fish at the market during the year was £38,174—a decrease of over £4000 for the previous year, and the quantity also decreased by about 10,000 baskets. The revenue of the department for licenses to fishermen and fishing-boats, rent on leased areas, fees, fines, &c., was £2216. The expenditure was £4830, the fisheries vote being £5891. Of the expenditure £100 was for marine fish-culture, and £700 for the erection of hatching-ponds. The report has a number of statistical appendices and reports from district inspectors.

4. UNITED STATES.

The Reports for the two fiscal years, 1889–90 and 1890–91, have been published together.* The amounts of money voted by the Government for carrying on the fishery work of the Commission during the years mentioned were as follows:—1889–90, 278,900 dollars (about £57,523); 1890–91, 298,900 dollars (about £61,648). The sums spent in the propagation and distribution of food fishes was 200,000 dollars; in the maintenance of vessels 53,900 dollars; and an inquiry respecting food fishes 20,000 dollars. The steamer 'Albatross' was engaged in fishery surveys in Bering Sea, and off the coasts of Washington, Oregon, and California, and also in a scientific investigation, under the direction of Professor A. Agassiz (in 1891), of the waters lying off the western coast of America, between Cape San Francisco and the Galapagos Islands on the south, and the Gulf of California on the north. On the Atlantic coast a complete survey has been made of the coast-waters of South Carolina in the interests of the oyster industry. In the spring of 1891 the 'Fish Hawk,' the other steamer belonging to the Commission, began an investigation of the great oyster regions in Chesapeake Bay, the principal object of which was to obtain as much accurate information as possible respecting the present condition of the beds, and the practicability of extending the area of production by artificial plantings, as has been done in Long Island Sound.

In the mackerel region off the southern New England coast physical inquiries have been carried on, under the direction of Professor W. Libbey, by the Fish Commission's schooner, the 'Grampus,' and the steamer 'Blake.' At several hundred stations, extending in parallel lines along the coast for distances of 130 and 150 miles, temperature observations were taken in some cases down to 500 fathoms. A very large series of vertical temperature sections has thus been obtained, which show very clearly the relations of the Gulf Stream with the colder

† *Report of Commissioner* for 1889 to 1891. Washington, 1893.

waters of the Arctic current, and are of special importance in relation to the migrations of the mackerel. The investigations respecting the inland waters have been undertaken on a very extensive scale, and have covered, to a greater or lesser extent, twelve different states and territories. That in relation to Alaska and its salmon fisheries is of special interest.

In the department of fish-culture there is a good deal to chronicle. Fish hatching was carried on at 22 hatching establishments, and the total number of eggs, fry and fish distributed from the various stations in the course of the two years was as follows:—Eggs 196,409,650; fry 525,783,273; yearlings and adults 2,400,094—or a total of 724,593,017. The great majority consisted of the white fish (*Coregonus*), the number of eggs and fry of this species distributed being 236,228,000; of 'pike perch,' the number was 188,131,000; of shad 138,337,000. Altogether 37 species of fish were dealt with in the piscicultural establishments. Among sea fishes operations were carried on with cod, pollock, haddock, mackerel, Spanish mackerel, "tautog" and flat-fish. The hatching work with the marine forms was confined to the Stations at Woods Holl and Gloucester, Massachusetts, and may be more particularly referred to. At Woods Holl, which is especially equipped for marine pisciculture, the number of cod to be used as spawners or source of egg supply during the first of the two years (1889–90) was 3403, which were obtained from fishermen between 22nd October and 19th November 1889. These were placed partly in live-cars, and partly in one of the tidal basins with which the hatchery is provided, to wait until the beginning of the spawning season. The brood fish being then mature were stripped of their eggs every two or three days until the supply was exhausted. Many of the adults died while in the enclosure. In the two months following, 91 fish yielded 8,545,700 eggs, and from these there were hatched and liberated in local waters, when from three to six days old, 5,861,100 fry. At the end of the spawning season 1000 of the brood fish remained, which were retained in one of the tidal basins to determine their value as spawn producers the succeeding autumn. Besides the eggs obtained from the brood fish, consignments were sent from Gloucester Station to the number of 3,822,980, and these produced 965,000 fry. The haddock eggs, to the number of 3,201,400, were obtained from Gloucester also, and produced 548,700 fry; the eggs of a flat-fish (*Pseudopleuronectes americanus*) were obtained to the number of 5,841,100, and the fry produced numbered 4,086,700. A number of other fish were dealt with: 4,271,200 eggs of the sea bass produced 3,893,700 fry. The total number of fishes eggs hatched during 1889–90 at Woods Holl was 28,230,200, and the number of fry produced and liberated in the local waters was 17,379,400. In addition 8,317,600 eggs of the lobster were dealt with, and 4,511,100 fry obtained, which were released in the local waters when two to four days old.

In the year 1890–91, 3000 selected brood cod were used, being retained in enclosures till the spawning season. The number of cod eggs obtained was 67,399,000, which produced 36,266,100 fry—and, in addition, 43,168,500 eggs were brought from Gloucester; but they suffered in transit, and only 150,000 fry were obtained from them. It is mentioned that Copepods were present in the hatching vessels in profuse abundance, cheese-cloth having failed to exclude them, and their presence was thought to be injurious, as they densely congregated about dead eggs and the weaker fry. The number of eggs of the flat-fish procured was 4,689,700, which produced 3,350,000 fry; and 3,533,900 fry of the lobster were also hatched and liberated.

At the Gloucester Station, in 1889–90, 14,899,000 fry were produced

from 40,166,300 eggs of the pollock; 14,957,000 fry from 47,556,000 cod eggs, and 5,192,000 fry from 30,322,000 eggs of the haddock. In the following years the figures were:—cod, 110,112,300 eggs and 18,968,100 fry, 43,514,300 of the eggs being sent to Woods Holl; haddock, 1,154,100 eggs and 78,600 fry; pollock, 38,546,200 eggs and 14,827,900 fry. After storms the turbid water caused the sinking of many eggs. In all the operations the eggs were run from the spawners and impregnated by mixing milt with them.

The number of cod planted in the Vineyard Sound region, prior to 1889, was about 38,000,000, to which the 43,800,000 for the two years covered by the Report have to be added—or a total of over 80,000,000 down to 30th June 1891. Particulars are given of the increase of cod-fish in this region in recent years since the liberation of the fry was commenced. The Appendices contain a number of valuable papers and reports.

A considerable amount of information in a condensed form, regarding the fisheries of the United States, is given in the annual report of the Boston Fish Bureau.*

It appears that the proposed new tariff bill decreases the duty on imported mackerel and salmon 50 cents a barrel; but the duty on fresh fish in ice remains the same. 'Fish, smoked, dried, salted, pickled, or 'otherwise prepared, three-fourths of 1 cent per pound. Herrings pickled, 'frozen or salted, and fish frozen or packed in ice for preservation, one-'half of 1 cent per pound.' A Fisheries Conference, called by the New York Fish Commission, and attended by representative men from all parts of the coast from Maine to Virginia, was held in New York in December last 'to consider the expediency of legislation to protect salt 'water fishes,' which were said to be diminishing in numbers and increasing in price. After two days' discussion the convention adjourned without taking action. From a highly appreciative statement respecting the work of the U.S. Fish Commission, it appears that, in the year ending June 1893, 160,292,500 fry, 15,360,500 fry, and 1,485,482 yearlings were distributed by the Commission, including 20,992,000 fry of cod, 1,189,000 of sea-bass, 288,000 of flat-fish, 434,000 of mackerel, and 8,818,000 of the lobster.

One of the Gloucester schooners made a voyage to Labrador and Baffin's Bay to catch halibut, trout and salmon; but the presence of ice caused the vessel to go to Greenland, whence she brought a cargo of 80,000 lbs. of salt halibut, 21 barrels fins, and 10 barrels salmon trout. Another Gloucester schooner visited Norway for mackerel; the weather was bad, and only 59 barrels were secured. The return voyage, a distance of 4400 miles, was made in 22 days.

The large handsome mackerel found on the Norwegian coast, and the high price they bring, are very alluring to American fishermen, 'who,' as the Report says, 'noted for their dauntless courage, do not hesitate to 'risk their lives and fortunes in any of the four corners of the globe' in quest of fish. Africa has also been visited for mackerel by American fishermen.

5. SWEDEN.

As has been mentioned in previous reports, no complete official statistics are published of the sea fisheries of Sweden. Dr Malm, the inspector, however, prepares annually a report relating to the important

* *Nineteenth Annual Report of the Boston Fish Bureau.* Boston, 1894.

fisheries of Göteborg and of the Bohus provinces. From his report for 1892–93,* which deals with the period from 1st April 1892 to 1st April 1893—and, therefore, includes the winter herring fishing, it appears the total value of these fisheries was 2,325,397 kroner, as against 3,763,740 kr. in the previous year. The chief fishery is that for herrings, which yielded 1,201,408 kr. Of this total, herrings to the value of 37,530 kr., were caught by drift-net in the autumn; the value of those caught by seine-net in winter was 600,250 kr., and the value of those caught by set-nets, also used in winter, was 563,628 kr. The value of the mackerel taken was 448,244 kr.; lobsters yielded 102,299 kr.; oysters 3280 kr.; saithe 22,145 kr.; sprats 57,067, kr.; salmon 20,640 kr. The deep sea fishery yielded fish of the value of 448,244 kr. This fishery is carried on beyond Skagen, and in it were employed 976 men and 95 boats, 16 of which fished at Shetland. The type of boat used in this fishing approaches more and more that of the English cutter. In the fishing in the Kattegat (included in the deep-sea fishing), 494 men and 85 boats were employed. The mackerel fishing is carried on by drift-net, seine-net and trolling. The value of those caught by drift—employed by 379 boats in the Kattegat and Skagerrak—was 174,862 kr.; by trolling in the North Sea (65 boats), 119,479 kr. Scotch coopers are still in the employment of Swedish curers in order to superintend the curing of herrings after the Scotch method. The number cured by the Norwegian method was 156,040, and the number by the Scotch system was 186,551. The number of kilogrammes of herrings exported from Gothenburg, Marstrand, Lysekil and Strömstad was 67,050,283. In addition, 9,954,996 kilos were forwarded by rail. The exports were chiefly to Germany and England. At the fish guano factories 217,046 hectolitres of herrings were used, and 4,360,000 kg. of guano, and 4514 casks of oil produced.

In the Lower House of the Riksdag, Dr A. V. Ljungman, the well-known authority on fisheries, recently introduced a fishery bill, especially relating to the right to exercise fishing on sea and shore and inland seas, in regard to which certain restrictions at present exist.† Section one, which deals with Crown benefices, the open sea, &c., proposes to allow every Swedish subject to carry on fishing in the open sea, and on such sea shores as belong to the Crown, and on rocks and islands in the salt-water lakes which do not belong to any farm. Fishing apparatus or fixed tackle are to be allowed, without special permission from the King being necessary, to be used in such waters, with certain exceptions. Section two deals with private rights on salt lakes and on the open shores. Fisheries within the belt of rocks (*momskär*) are, with certain exceptions, to be private property, like the shores and islands around them. The private right of the possessor of the shore does not extend further than the beach extends into the sea. If it is not legally determined how far out this extends, it is to be considered that private rights exist to all the water up to and including 180 metres from the place on the shore, where there is a constant depth of two metres. Possessors of shore rights alone are permitted to set baskets and such like fixed engines further out. Other sections deal with similar points. In regard to the fishing for strömming, the peculiar small Baltic herring, every Swedish subject is to be allowed to carry on this fishery without molestation from landowners, even on another shore, in so far as the shore consists of woodland or stone, and not of arable land or meadows, and after the landowners have enjoyed their privilege on two free days, namely, Monday and Wednesday, to first make a draw of the nets, if they are present and wish to make use of

* *Berättelse öfver Göteborgs och Bohus läns hafsfisken, under* 1892–93, *afgiven till Kongl. Maj:ts Befallningshafvande af A. H. Malm.* Göteborg, 1893.

† *Bih. till Riksd. Prot.*, 1894, 1 Saml. 2 Afd. 2 Band, 2 Häft.

their privilege. No subject may close any shore whatever for the general fishing of the large herring on the west coast, notwithstanding any private rights to the shore, and the same holds in the Baltic where the fishing is steady. Among other provisions is the permission to every Swedish subject to fish with hook and line within the outer skärgarder (the belt of rocks fringing the coast) and in the offing. In inland lakes, whose greatest breadth exceeds 50 kilometres, every Swedish subject shall be permitted to fish with hook or line, subject to reservations of the shore waters.

Foreigners are not to be permitted to exercise fishery within the bounds of the kingdom, unless the right is granted to them; there are certain conditional exceptions in favour of Danish subjects in the Öresund fishings, and the herring fishing at Bornholm. Various provisions apply to the regulation of the procedure on the fishing grounds—the general rule is, that set-nets and long-lines must give way to drift-nets and seines.

In the report of the Board of Agriculture for 1892, are various papers and reports, dealing with rural economy, fisheries, &c. Certain local societies have assigned sums of money for technical instruction in fishery matters, and have begun investigations on certain fisheries, as those for salmon and eels. There are also statistics relating to the fisheries of particular provinces, from which a few quotations may be made:—In Blekinge province the total value of the fish landed was 712,530 kr.; the salmon fishery in the sea was carried on by 250 boats and 533 men; the herring fishery by 1160 men in 374 boats. In Malmöhus province the value of the fish caught was 700,439 kr.; herrings yielded 2,853,080 kilogr., valued at 404,055 kr.; 'flounders' (in the Kattegat) 89,496 kr.; cod (in Kattegat) 346,744 kilogr., valued at 72,799 kr.; eels were valued at 49,467 kr., and lumpsuckers (129,566 kilogr.) at 5979 kr. In Halland province the herring fishery yielded 72,000 kr.; cod, coalfish, 'flounders,' &c., 127,000 kr.; salmon (sea fishery) 65,000 kr.—the total for all being 282,000 kr. The statistics relating to the Göteborg-Bohus provinces are given in Malm's report above referred to. It appears that, in 1892, 29,650,712 kilogrammes of cured herrings, and 108,001,808 kilogr. of fresh herrings were exported from these provinces; in addition the eight guano factories in the province used about 19,500,000 kilogr., and produced 4,360,000 kilogr. of guano. In the Skaraborg province the net value of the fish landed was 213,210 kr. In Vermland province the take of salmon amounted to 67,993 kilogr. of the value of 86,000 kr. In Vesternorrland province the strömming fishery yielded about 18,700 barrels, valued at 210,657 kr.; the salmon caught in the sea amounted to 30,315 kilogr., valued at 29,535 kr., besides 86,000 kilogr. caught in the rivers. There are six establishments in this province for fish-culture. In the Göteborg-Bohus provinces, the Economic Society granted 13,171 kr. for fishery purposes, including 6500 kr., for instruction in the curing of herrings. In the Vermland province 3000 kr. were granted for fishery investigations. A fish-cultural and biological station has been established at Finspong.

In one of the Swedish fishery periodicals a considerable number of interesting papers have been published.* Some deal with the fishery department of the Chicago Exhibition, others with the question of the decrease in the fishes of the North Sea, the Swedish piscicultural establishments, the biology of the eel, &c., &c. A giant lobster was caught at Grebbestad, nearly 2½ feet long; it was covered with shells and mussels.

* *Svensk Fiskeri Tidskrift*, 1893.

6. NORWAY.

The operations at the sea-fish hatchery at Flödevig, Arendal, under the direction of Captain G. M. Dannevig, during the present year were chiefly, as in previous seasons, concerned with the cod. Although the season, from the late melting of the snow, was not as favourable as usual, a very large number of fry, amounting to about 100,000,000 were produced and liberated in the waters of the fjords around the neighbouring coast. Since the hatchery was established, about 900,000,000 cod fry have been added to the waters, and the increase of young cod on inshore grounds, referred to last year, continues to be marked. The large pond, which has been used as an experimental rearing-pond, has been divided into two by a wooden partition, and a spawn-collector erected in connection with one of the divisions. Captain Dannevig intends to use this as a spawning-pond for flat-fishes, such as plaice and halibut.

The official statistics, in connection with the Norwegian sea fisheries,* show that in the year 1892 the total value of the produce of the coast fisheries was 24,794,000 kroner, a decrease of 1,172,000 kr., as compared with the previous year. The value of the cod fish landed was however greater, being 15,272,000 kr. as against 14,111,000 kr. in 1891, and 14,075 kr. in 1890. The decrease was chiefly in herrings, and also in mackerel. In 1891 the 'fat'-herring fishery yielded 3,083,000 kr., while in 1892 it gave only 2,193,000 kr., and the value of the spring herring also fell from 3,256,000 kr. to 2,450,000 kr. Mackerel produced only 393,000 kr. as against 659,000 kr. in 1891, and 512,000 kr. in 1890. The lobsters landed were valued at 313,000 kr. as against 369,000 kr. in the previous year. Oysters continue to diminish, the value last year being only 7,000 kr. In the previous year their value was 13,000 kr., and in 1890 14,000 kr. In regard to the different parts of the Norwegian coast, which contributed to the total of the fishery products, the south coast from the Swedish frontier to Lindesnes yielded fish to the value of 2,530,000 kr., a great increase on the amount for the previous year. The North Sea coast, from Lindesnes to Stat, furnished 2,193,000 kr.; the Arctic Sea coast (*Ishavets Kyst*), yielded 5,349,000 kr.; but the great bulk of the fish was landed on the north-west coast (Norske Havs), from Stat to Sørøen in Finmarken, the value being 14,722,000 kr., as against 15,560,000 in 1891 and 16,156,000 in 1890. The total number of fishermen employed does not appear to be given in the official report, probably from the difficulty of distinguishing between the fishermen by occupation and the occasional fishermen. The numbers engaged in the great fisheries are, however, given. In 1892 the number of men employed in the cod fishery was 101,659; those in the fat-herring fishery, 28,437; and those in the mackerel fishery, 3,117. The number of cod fishermen is increasing, while the number of herring fishermen is diminishing; in 1888 the respective totals were 81,394 and 48,201. The great increase in the former has taken place mainly in Finmarken, while the herring fishermen seem to have decreased in numbers along all the coasts. The great fishery, as has been said, is the cod fishery, which is carried on mostly in winter and spring. The produce landed in 1892 was 65,086,000 cod, as against 49,612 in 1891; cod livers measured 171,132 hectolitres, and roes 55,286 hectolitres. The herring fisheries yielded 1,825,771 hectolitres, to which the well-known fat-herring contributed 1,049,642 hectolitres, and the winter and spring

* *Tabeller vedkommende Norges Fiskerier i aaret*, 1892. Kristiania, 1893.

herring 776,129 hectolitres. The average price was 2·54 kr. per hectolitre. The quantity of herrings caught was greater by 500,000 hectolitres in 1892 than in 1891, but the value was 1,697,000 kr. less. The great fall in value was in the fat-herring fishery carried on in summer and autumn. Although the quantity caught in 1892 was almost double what it was in the previous year, the value was less by nearly a million kr., the average price per hectolitre falling from 5·24 kr. in 1891 to 2·09 kr. in 1892. The catch of sprats and 'small herrings' amounted to 125,000 hectolitres, valued at 330,000 kr. The mackerel fishing is an important one in Norway, especially in relation to cured mackerel for the American market. The catch fell from 5,381,000 fish in 1891 to 2,639,000 in 1892; the average price was higher, namely, 14·87 kr. per 100 fish, as against 12·21 kr. in the previous year. The catch of lobsters has steadily fallen from 855,000 in 1888 to 549,000 in 1892.

The value of the fish and fish-products exported from Norway in 1892 amounted to 45,737,000 kr., of which cod yielded 33,006,400; herrings, 10,420,700; and other fish, 2,309,900 kr. A comparison of the figures for a series of years shows an increase in the value of cod, and an decrease in the value of herrings exported.

7. DENMARK.

The official Report on the fisheries during the financial year, 1892–93, contains a great deal of information respecting them.* The various fishery regulations and bye-laws, which have been modified or established, are set forth in the first chapter, and are on the same lines as have been described in previous reports. The statistics referring to the west coast of Jutland show that the total value of the fish caught in the North Sea and Skagerrak, and landed on this part of the coast, was 552,721 kroner. The most important fish was the haddock, of which 2,977,447 lbs. were landed, of the value of 204,216 kr. The quantities and values of other fish were as follows:—Cod, 1,774,001 lbs., worth 98,693 kr.; whitings, 274,865 lbs., and 13,756 kr.; plaice, 2,178,447 lbs., and 99,104 kr.; flounders, 292,287 lbs., and 38,115 kr.; soles, 581 lbs., and 377 kr.; turbot and brill, 5173 lbs., and 1049 kr.; herrings, 24,000 lbs., and 13,170 kr.; mackerel, 24,680 lbs., and 8418 kr. The number of lobsters caught was 26,678, valued at 54,347 kr. The Danish fishing fleet in the North Sea, in 1892, numbered 531, of 5418½ tonnage. The fisheries inside the Skaw (exclusive of those of Limfjord) yielded fish of the total value of 3,918,368 kr., as against 3,795,349 kr. in the previous year. The values of the principal fish from these waters were as follows:—Cod and haddock (included together) 443,034 kr.; flounders (including dabs), 1,198,395 kr.; soles, 213,259 kr.; turbot and brill, 26,138 kr.; mackerel, 10,282 kr.; herrings, 720,289 kr.; eels, 798,949 kr.; salmon, 192,232 kr. From places within the Skaw, 165 cutters and 128 open boats, manned by 1153 men, prosecuted deep-sea fishing in the Kattegat and North Sea, catching fish to the value of 1,264,392 kr., most of them being flat-fish. In the Limfjord the number of boats employed in the fisheries was 1209, of a gross value of 141,381 kr.; the value of the fishing gear was 292,892 kr.; and the value of the fish landed 1,040,872 kr. The value of the eels caught was 462,481 kr.; flat-fish, 300,870 kr.; herrings, 64,440 kr.; cod (and haddock), 164,576 kr. In appendices to the report the results of an investigation into the fish and

* *Fiskeri-Beretning for finantsaaret*, 1892–93, *af C. F. Drechsel.* Kjøbenhavn, 1893.

other marine fauna of Iceland are given, and also of the investigations at the Biological Station in Denmark, by Dr C. G. Joh. Petersen, the Director. A series of observations were made as to the pelagic life in Fænø Sound. The currents in this Sound are strong, and the biological station being moored in the Sound, Dr Petersen was able, by hanging over tow-nets, to make considerable collections, extending from 4th April to 11th November 1891, and from 2nd April to 1st September 1892. It was found that the character of the pelagic life varied considerably in different months, as Professor M'Intosh also demonstrated was the case in St Andrews Bay.* Dr Petersen gives tables, showing the outstanding features of the plankton in each month, especially the eggs and fry of fishes, and indicates four periods, roughly corresponding to the four seasons, under which the phenomena may be grouped. It appears that the fry from pelagic eggs were much rarer than the fry of fishes with demersal eggs; pelagic eggs sometimes occur in immense numbers, but the fry are comparatively scarce. The conclusion seems to be that the pelagic eggs are not hatched there, and cases are given in which they were evidently borne by currents from the Kattegat. The relation of currents and of the specific gravity of the water to the distribution of fish eggs and larval fishes is discussed. In a second paper Dr Petersen deals with the pelagic fish eggs in the Lesser Belt, which are sometimes found in these waters in great abundance, and include those of *Gadus callarias*, *Motella*, *Pleuronectes vulgaris* (*platessa*), *P. flesus*, *P. limanda*, *Clupea sprattus* and *Trigla;* and he also gives the results of many observations respecting the rate of growth of certain food-fishes, and the distribution of the young at various stages. He is of opinion that *Pleuronectes platessa* and *P. flesus* take, as a rule, three years to reach sexual maturity; that the cod, in its first year, grows to the length of from about 3¼ to 9 inches, and, in its second year, from about 9 to 15 inches. He indicates that he has found in April female as well as male cod nearly ripe, at and under 13 inches in length, one female, indeed, at 10 inches. There are a number of observations regarding other fishes. Dr Petersen is of opinion that *Spinachia vulgaris* reaches maturity, breeds once, and then dies or disappears. Chapters are given on the conditions of the bottom, and the plant and animal life at Fænø, and on the local fisheries.

8. HOLLAND.

The information available respecting the fisheries of the Netherlands is, as usual, considerable. The official Report contains voluminous statistics.† It is stated that the herring fishing of 1892 will be long remembered for the enormous catch, which exceeded 500,000,000 herrings, the greatest for a century. They were generally of good quality, but small, and the prices were low. The average price of 8·60 florins compared badly with the average of 16·25 florins in the previous year. In the great fishery, 521 vessels were engaged, of which 221 were luggers and sloops, and 300 were *bomschuiten*. The total number of barrels of pickled herrings brought into port was 536,828. The supply of cured and fresh herrings by *bomschuiten* at Scheveningen, Katwijk, and Noordwijk was 244,312 barrels of cured, and nearly 50,000,000 of fresh herrings. The demand in the foreign markets, especially in Germany, was brisk, but prices were very low; the export to America is increasing. In the line fisheries the result

* *Fishery Board Report*, Part III.

† *Verslag van den Staat der Nederlandsche Zeevisscherijen over* 1892. 'S Gravenhage, 1893.

was unfavourable, the quantity caught was not large, and the prices were low. From Vlaardingen 52 boats took part in this fishery, and from Massluis 17. Trawling was carried on from Massluis by about 10 *schokkers* or *blazers*, and the fish were taken direct to the Rotterdam market. The export of cured cod amounted to 1,829,000 kilogrammes. Full accounts of the fisheries in the various provinces are given. In the Zuiderzee, notwithstanding good results in some branches, the fishery was, owing to the failure in that for anchovies, extremely small in comparison with former years; and this has told severely on the fishing population around the shores. The new anchovy net has also made the carrying on of the fishery more expensive. The oyster fishery was on the whole not unfavourable on the Yersche and Bergsche banks. The winter of 1891–92 was not severe, and therefore less loss occurred than usual; and the weather in summer was suitable for a good spatting. The oysters exported amounted to over 1,000,000 kilogrammes.

Plans and estimates have been prepared, under the direction of Dr P. P C. Hoek, for the construction of a steam vessel for scientific investigations in connection with the Dutch fisheries, on the type of the latest-built Grimsby steam trawlers, at a cost of about 45,000 florins. Instruction of the fishing population, in various matters connected with their industry, has been carried on at various fishery schools. A petition was considered by the College, requesting that the meshes of the *fuiken* and *kuilnetten* in the Zuiderzee should be increased to at least 18 mm. in width. The opinion given was, that while it was desirable that the meshes should be wider than those now used, especially in the interests of the eel-fishery, it was not wise to interfere. At present the fishery in the Zuiderzee is quite free, and, while this has certain disadvantages, it has also its good side, for it leaves in the hands of the fishermen themselves the making of regulations to suit their own interests. Complaints have been made of the fishing of English trawlers within the territorial waters.

The College have recently established a monthly journal, much on the same lines, or, at all events, for the same purpose, as the Bulletin of the United States Fish Commission, namely, in order to make public, as rapidly and widely as possible, information which may be of service to those engaged in the fishery industry.* It is edited by Dr Hoek, and is divided into two sections, one for official communications, and the other for information of various kinds. The official section of the first two numbers (for January and February 1894), contain extracts from the log-books of the vessels 'Zeehond' and 'Bonaire,' charged with the supervision of the fisheries in the North Sea. Reports are given of the daily supplies and prices of fish, such as herrings, smelts, flounders, eels, shrimps, &c., at various fishing-places; and also of daily observations on the temperature and salinity of the sea-water at selected stations, and on the weather. Dr Hoek gives an account of the natural history of the anchovy, and discusses various questions connected with the fishery for it.

Dr Hoek, the Director, has given an account of the work at the Zoological Station at Helder, and of the arrangements for study at the laboratory, during the year 1892.† At the seventh annual meeting of the Society for the Promotion of Dutch Fisheries, a number of fishery questions, chiefly of local interest, were discussed.‡ An important one

* *Mededeelingen over Visscherij: Maandblaad in overleg met het College voor de Zeevischerijen uitgegeven door*, Dr P. P. C. Hoek, Jaargang 1894. Helder.

† *Het Zoölogisch Station der Nederlandsche Dierkundige Vereeniging in* 1892. Leiden, 1893.

‡ *Verslag van de Zevende Jaarlijksche Algemeene Vergadering van de Vereeniging ter bevordering van de Nederlandsche Visscherij, gehouden te Amsterdam, op Maandag 8 Mei*, 1893. Leiden, 1893.

referred to the proposal to drain the Zuiderzee. The Society, as might be expected, opposed this proposal. It appears, however, that the Royal Commission, presided over by M. Lely, the Minister of the Waterstaat, which has been inquiring into the schemes for the draining and reclamation of this great area, has concluded its labours. Twenty-one members, out of the twenty-eight composing the Commission, recommend that the proposal should be carried out. If this is done, it appears that about 450,000 acres, of an estimated value of 326,000,000 guilders, will be added to the territories of the Netherlands. The expense will be very great and is computed at 180,000,000 guilders, or, including interest, measures for defence, and compensation to the fishermen whose means of livelihood will be taken away, at 315,000,000 guilders. It is proposed to drain the sea by carrying a sea-dyke from North Holland into Friesland.

9. FRANCE.

Professor A. F. Marion and his colleagues continue their important scientific labours at the Zoological Station, Marseilles. In the publication for the third year of the work,* Prof. Marion gives, in an introductory statement, a clear and concise explanation of the objects and methods of scientific fishery research in inshore waters. Physical and meteorological observations were taken daily at the station, and notes are furnished in connection with them of the success of the fishings. Statistics are given by M. Paul Gourret of the fish commerce of Marseilles, and descriptions of various modes of fishing in the neighbourhood. In recent years the natural history of the sardine has attracted much attention and study in France. In the present volume Professor Marion returns to the subject, dealing specially with the season 1890–91 on the coast of Marseilles. He reviews Mr J. T. Cunningham's investigations on the reproduction and growth of the pilchard.

M. Paul Gourret also gives the results of his continued researches on the food of a large number of species of sea fishes, and upon the degree of sexual maturity at various seasons. Professor Marion has notes on the mackerel and anchovy, and on the reproduction of the lobster and oyster.

A considerable number of fishery investigations have been carried on at the Station Aquicole, at Boulogne-sur-mer, by the Director, Dr H. E. Sauvage, and his colleague Dr Canu. They are described in the Annals of the Station.† In a paper, in the first part, on the 'Herring on the Coasts of Normandy,' it is pointed out that the herring fishery in Europe practically terminates at the southern part of the Normandy coast, although the fish is taken in small quantities on the coast of Bretagne. From the middle of October to the beginning of March, herrings are especially abundant in the south parts of the North Sea, in the Channel between Portland and the Cape de la Hague; the fishery is carried on from Dunkirk, Calais, Boulogne, Saint-Valery-en-Caux, Tréport, Dieppe, Fecamp, &c. Statistics of the quantities caught are given, and a number of herrings from different localities were examined in order to determine the degree of maturity at different dates. Notes are also given of the food found in the stomachs of the herrings; the greater part consisting of a Copepod, *Temorella affinis*, which is described and figured. In another paper by Dr Sauvage, the food of forty-two species of marine fishes is described. Dr Canu furnishes an account, with illustrations, of the Copepoda parasitic on fish in the

* *Travaux de Zoologie Appliquée.*

† *Annales de la Station Aquicole de Boulogne-sur-mer, publiées sous les auspices du Ministère de l'Agriculture*, vol. i. parts i. ii., 1892, 1893.

neighbourhood of Boulogne; and also a paper dealing with the curing of mackerel for the American market. In the second part of the Annals, Dr Sauvage reviews the fisheries of Boulogne in the decennial period 1880–89, and gives an account of an investigation made into the condition of sexual maturity of twenty-one species of fishes. Other papers deal with the pelagic fauna, and with the spawning, eggs, and larvæ of Teleosteans. In the latter,* Dr Canu points out the importance to the fisheries of accurate knowledge concerning the reproduction, eggs, and larvæ of the food-fishes, and of its bearing on fish-culture. The eggs or larvæ of the dab, flounder, plaice, lemon-dab, turbot, brill, solenette, sole, cod, whiting, and rockling (*M. mustela*) are described and figured. Dr Canu found female plaice, only 10 inches long, containing ripe eggs. Dr Sauvage, in a separate pamphlet, deals with the utilisation of the bye-products in fisheries.† In a second paper Dr Eugene Canu deals with marine pisciculture in relation to the French coasts of the Channel.‡

10. SPAIN.

In the publication devoted to Spanish fisheries§ the editor, Lieutenant Rafael Gutierrez Vela, has brought together a great deal of interesting information. Like the *Mededeelingen* of the Netherlands department, the *Revista* is divided into an official and a technical section. There are a series of articles in the numbers for last year by Señor Borja on the zoology of marine fishes; and many others dealing with fishery questions In a paper on the fisheries of the Canaries, it is stated that an immense and valuable fishing bank exists on the west coast of Africa, which has been termed the 'African Newfoundland Bank,' and which is regarded as a rich fishery 'mine' for the fishermen of Spain. On this bank are to be found abundance of *bacalao* or 'cod,' but this species is not the true *Gadus morrhua* of the northern seas, although in the cured condition it closely resembles it. The tunny, sardine, and a species of herring also abound. The establishment of a Spanish fishery at Iceland is strongly advocated, especially for the cod fishing, since Spain is at present largely dependent on other nations for its supplies of this fish. In 1890, 43,593,193 kilogrammes of dried cod were imported, and it is believed that by the organisation of a Spanish fishery, most of this industry might become national, with the result of saving much money to the Spanish people.

Lieutenant Vela, in an interesting and instructive paper, deals with Spanish fishery statistics, which, it appears, are still very imperfect, and points to the importance of organising them in a better way. At the Monasterio de Piedra, Señor Muntadas has built a piscicultural establishment for trout and salmon, the Government having granted a sum of 21,125 pesetas in connection with it. The sum of 6500 pesetas is also annually granted for the experimental marine biological station at Santander, established by royal decree in 1886.

In Spain they have also a trawling question—the great trawl or *bou* being used, and Señor Joaquin de Borja was appointed by royal decree to investigate the subject in the maritime province of Barcelona, and recently presented his report to the Junta de Pesca. As in this country, the complainers are fishermen using other kinds of fishing tackle.

* 'Ponte, œufs et larves des poissons osseux, utiles ou comestibles, observés dans la Manche,' *Annales*, part ii. p. 117.

† *Les produits secondaires de la pêche.* Boulogne-sur-mer, 1892.

‡ 'Notes sur la pisciculture marine et son application rationnelle aux côtes francaises de la Manche," *Annales*, vol. ii., 1894.

§ *Revista de Pesca maritima.*

It is recommended to institute a close time for this mode of fishing from April to the end of September.

In a paper by the Conde de Peracampo on the same subject, the researches of Sars, Raffaele, M'Intosh, Marion, and others respecting the eggs of fishes in relation to trawling are referred to, and the utility of carrying on scientific investigations by the aid of zoological stations advocated—reference being made in this connection to the Marine Laboratory at St Andrews, and to the marine piscicultural establishment at San Sebastian.

11. RUSSIA.

A year or two ago, under the auspices of the Government, a Commissioner from the Ural district, Dr N. Borodine, was sent on a tour through the various maritime States of Europe and America, extending over two years, for the purpose of obtaining as much information as possible relating to foreign fisheries and pisciculture. Dr Borodine, on his return, was appointed Fish Commissioner of the Ural district, with powers to carry on scientific investigations in connection with the fisheries. The fisheries of the Ural Cossacks, who are noted as peaceful fishermen as well as brave soldiers, are of great importance and value, and of a special kind. The right of fishing in communal waters does not belong to any but members of the community, and the Ural river from Uralsk to the Caspian Sea, a distance of 330 miles, is entirely given over to the fishing industry, all kinds of commercial navigation being absolutely forbidden in this great stretch of water. At some parts of the river, where the sturgeons congregate in winter, no one is allowed to run a boat or make any noise; and summer fishing is almost totally prohibited in order to protect the spawning. At Uralsk a railing is constructed across the river to prevent the larger fishes going further up, and fishing is not allowed to begin until a date fixed by general agreement. The fishing is carried on by more than 10,000 fishermen. There is a great autumn and a great winter fishing. On a certain day a great army of fishermen, with carts on which are carried the light boats and the nets, move along the banks to the fishing-places, and, on the firing of a cannon by the chief, the 3000 boats are launched and make for the best places. Seines are used, and various kinds of sturgeon (from 30 to 600 lbs. in weight), carp, bream, and silurus are caught. The total quantity caught in the autumn fishing is from 54,000,000 to 72,000,000 lbs., which comprises over 200,000 lbs. of sturgeon, and more than 21,000 lbs. of caviar; 10,000 carts distribute the catch to the markets. The winter fishing is carried on in the upper part of the river through the ice, by means of a hook on the end of a long haft, which is moved up and down in the water; the fish is hooked with a jerk, and hauled to the surface. Various kinds of sturgeons are taken, to the amount of about 1,800,000 lbs.; the quantity of other kinds of fish is about equal to this. There are also other fisheries carried on in spring and winter in the Caspian Sea. The fish exported from the Ural district in 1891 was 5,817,464 lbs. of sturgeon, 73,960,820 lbs. of other fish, 1,076,076 lbs. of fish roe, 173,348 lbs. of dried sturgeon steak (*balik*), and 6080 lbs. of isinglass.

INDEX.

Acartia, 235.
—— *clausi*, 235.
Acidostoma, 262.
—— *obesum*, 262.
Acontiophorus, 261.
—— *elongatus*, 261.
Acroperus harpæ, 286.
Agonus cataphractus. *See* Pogge.
Alona guttata, 286.
—— *quadrangularis*, 286, 288.
Alonopsis elongata, 286, 288.
Ameira, 240.
—— *exigua*, 243.
—— *exilis*, 242
—— *longiremis*, 241.
—— —— var. *intermedia*, 242.
—— reflexa, 240.
Ammodytes tobianus. *See* Sand-eel.
Ampeliscidæ, 263.
Amphilochidæ, 263.
Amphilochoides, 263.
—— *pusillus*, 263.
Anderson, Mr J. G., 24.
—— Mr J. M., M.A., B.Sc., 218.
Anguilla vulgaris. *See* Eel.
Apherusa, 264.
—— *borealis*, 264.
Archer, Mr W., 294, 297.
Arnoglossus megastoma (Sail fluke), 224.
Ascomyzontidæ, 260.
Atlantic water in North Sea, 352.
Attheyella crassa, 286, 288.
—— *pygmæa*, 286.
Atylidæ, 264.

Ballantrae, seine-net fishing at, 18.
Barra, mackerel of, 17.
Beam-trawlers, catches of, 181.
—— statistics of, 177.
Beam-trawling, 8.
—— Area of waters closed to, 8.
—— Effects of, on eggs of fishes and young fishes, 193.
—— Effect of, on invertebrate fauna and fish-food, 184.
—— Experiments of the 'Garland,' 12.
—— Regulations regarding, 9.
—— Regulation of, in Ireland, 388.
—— Result of closure of inshore waters to, 167.
Table A.—Summary of fish taken by the 'Garland' on the East Coast in 1892, 35.

Beam-trawling—*continued*.
Table B.—Analysis of the 'Garland's statistics, 42.
Table C.—Record of observations made on board the 'Garland' on the East Coast, 45.
Table D.—Buckhaven haddock and cod line fishing, 142.
Table E.—Showing the monthly takes of line and net boats from inshore grounds in the Leith, Anstruther, Montrose, and Stonehaven districts, 143.
Table F.—Showing the quantities of fish (in cwts.) captured by line fishermen in the territorial waters of certain districts, with the average per 'shot' in 1891, 1892, 1893, 161.
Table G.—Showing the quantities monthly of large and small fish landed in Aberdeen district by beam-trawlers and line fishermen in 1893, 162.
Table H.—Showing the monthly amounts in cwts. of round and flat fish landed by line fishermen and beam-trawlers on the East Coast of Scotland during 1893, 164.
Beam-trawl fishery in relation to the fishing grounds and fishes, 176.
Borodine, Dr N., 404.
Bosmina longirostris, 286, 288.
Bounty-system in Canada, 391.
Brodick lobster pond, 11.
Brown, Dr H. Reynolds, 297.
Buckhaven haddock and cod line fishing, 31.
Bythotrephes longimanus, 286.

Caine, Mr W. S., M.P., 287.
Calanidæ, 235.
Campbell, Captain R., 24.
Camptocercus macrurus, 286.
Canada, fisheries of, 390.
—— money spent on fisheries in, 390.
Candona candida, 286.
—— *lactea*, 286.
Capture of immature fish, 18.
Cerebratulus, 265.
—— *angulatus*, 265.
Chydorus sphæricus, 286, 288.

Cletodes, 250.
—— *curvirostris*, 250.
—— *irrasa*, 250.
Cod, hatching of, in Norway, 398.
—— in the United States, 394.
Contemporary Fishery Work, an account of, 21, 383.
Canada, 390.
Expenditure on fisheries, 390.
Value of fisheries, 390.
Men engaged, 391.
Bounties given, 391.
Lake fisheries, 391.
International Commission, 392.
Fish-culture, 392.
Denmark, 399.
Value of fisheries, 399.
Scientific investigations, 400.
France, 402.
Scientific work at Marseilles, 402.
Scientific work at Boulogne, 402.
Fish-culture, 403.
Holland, 400.
Statistics of fisheries, 400.
Steamer for investigations, 401.
Fishery bulletins, 401.
Zoological station, 401.
Draining of Zuider-See, 402.
New South Wales, 393.
Statistics of fisheries, 393.
Fish-culture, 393.
Norway, 398.
Fish-culture, 398.
Statistics of fisheries, 398.
Value of exported fish, 399.
Russia, 404.
Commissioner for Ural district, 404.
Sturgeon fisheries, 404.
Spain, 403.
Fisheries at Canaries, 403.
Fishery at Iceland, 403.
Fishery statistics, 403.
Trawling, 403.
Sweden, 395.
Statistics of fisheries, 396, 397.
Fishery Bill, 396.
United Kingdom, 385.
Report of Parliamentary Committee, 385.
Territorial waters, 385.
Marine Biological Association, 385.
Report on sea fisheries, 386.
Lancashire Sea Fisheries Committee, 386.
Irish fisheries, 387.
Congested District Board, 388.
Kinsale fishing, 390.
United States, 393.
Expenditure on fisheries, 393.
Work of fish Commission, 393.
Fish-culture, 394.
Contributions to the life-histories and development of the food-fishes, 218.
Copepoda, list of, 232.
—— new species of, 231.

Cottus scorpius. *See* Sea-scorpion.
Cunningham, Mr J. T., 302, 386.
Currents in North Sea, 351.
Cyclocypris globosa, 286.
Cyclopidæ, 237.
Cyclopina, 237.
—— *elegans*, 237.
—— *gracilis*, 237.
Cyclops affinis, 288.
—— *fimbriatus*, 286.
—— *macrurus*, 286.
—— *magnotavus*, 286.
—— *serrulatus*, 286, 288.
—— *signatus*, 286, 288.
—— *strenuus*, 286.
—— *thomasi*, 288.
—— *viridis*, 286, 288
Cyclopterus lumpus. *See* Lumpsucker.
Cypria serena, 286.
Cytheridæ, 262.
Cytheropteron, 262.
—— *humili*, 262.

Dactylopus, 254.
—— *coronatus*, 255.
—— *stromii*, 254.
Dannevig, Captain G. M., 196, 398.
—— Mr Harald, 9, 208, 210.
Daphnia jardinii, 286.
—— *pulex*, 288.
—— —— var. *nigrispinosa*, 288.
Delavalia, 244.
—— *reflexa*, 244.
Denmark, fisheries of, 399.
Density observations, 339.
Dermatomyzon, 260.
—— *gibberum*, 260.
Development of food-fishes, 19, 218.
Diaptomus gracilis, 286.
—— *serricornis*, 288.
Dickson, H. N., F.R.S.E., F.R.G.S., 21, 336.
Diminution of flat-fishes, 9.
Diminutive-sucker, rate of growth of, 334.
Dunbar, creeks at, 202.
Dunbar hatchery, description of, 10, 196.
—— Work at, 10, 210.
Duthie, Mr R., 17. 187, 218.

Eel, Common, pathological changes in, 295.
Effect of hooks of liners on fish-food, 191.
Eggs of turbot, 223.
—— development of, in ovaries, 386.
—— of green-cod, 218.
—— of hake, 224.
—— list of pelagic, 298.
—— Norwegian topknot, 228.
—— sail-fluke,
—— sand-eel, 313.
Eurycercus lamellatus, 286.
Experiments on mesh of nets, 302.

Fauna, invertebrate, of inland waters, 284.
Fauna of Firth of Forth, additions to, 231.

Firth of Clyde, trawling in, 12.
—— of Forth, trawling experiments in, 13.
—— of Forth, additions to fauna of, 231.
Fisheries of England and Wales, 386.
Fish-culture in Canada, 392.
—— in France, 403.
—— in New South Wales, 393.
—— in the United States, 394.
Flat-fishes, decrease in supply of, 9, 384.
Food of young flat-fishes, 387.
France, fishery investigations in, 402.
Fullarton, Dr J. H., 20, 313.
Fulton, Dr T. Wemyss, 219, 231, 297, 383.

Gammarus pulex, 288.
Garland, 7, 8, 12, 19, 298.
Graptoleberis testudinaria, 286, 288.
Green-cod. *See* Saithe.
Gurnard, anatomy of the pectoral arch of, 322.

Haploops, 263.
—— *tubicola*, 263.
Harpacticidæ, 239.
Hatchery for sea-fish at Dunbar, account of, 196.
—— capacity of, 208.
—— hatching-house, 201.
—— pumping apparatus, 198.
—— spawning pond, 196.
—— spawn-collector, 199.
—— tidal pond, 202.
—— treatment of fry, 208.
—— work at, 203.
Hatching of food-fishes, 8.
—— operations at Dunbar, report on, 210.
—— of cod, 11.
—— lemon soles, 11, 207.
—— lobsters, 11.
—— plaice, 10, 204, 210.
—— soles, 11, 205.
—— turbot, 11, 206.
Herdman, Professor, 387.
Herring fishing in Sweden, 396.
Herrmannella rostrata, 259.
Heteropsyllus, 252.
—— *curticaudatus*, 252.
Holland, fisheries of, 400.
—— steamer for scientific work, 401.
Holt, Mr Ernest W. L., 205, 302.
Hoek, Dr P. P. C., 400, 401.
Hydrographic changes in North Sea, 21.

Ilyocryptus sordidus, 286.
Inadequacy of present limit of territorial waters, 11, 12.
Inland waters, invertebrate fauna of, 284.
Innervation of free rays in gurnard, 328.
Immature fish, capture of, 18, 302.
—— experiments on vitality of, 387.
—— plaice at Grimsby, 386.
—— suggested limits for sale of, 385.
Iphimedia, 264.
—— *minuta*, 264.
Iphimedidæ, 264.
Ireland, congested districts board, 389.
—— fisheries of, 388.
—— instruction in fishery matters, 389.
Isle of May, eels of, 295.

'Jackal,' H.M.S., 21, 301.

Lake fisheries in America, 391.
Lancashire Sea Fisheries' Committee, 205, 386.
Laophonte, 245.
—— *denticornis*, 246.
—— *depressa*, 245.
—— *littorale*, 247.
—— *simulans*, 248.
Laophontodes, 249.
—— typicus, 249.
Larval fishes, list of, 298.
Lemon soles, hatching of, 11.
Lepidepecreum, 262.
—— *carinatum*, 262.
Leptodora hyalina, 286.
Leptopsyllus, 253.
—— *typicus*, 254.
Leucothoë, 264.
—— *lilljeborgii*, 264.
Leucothoidæ, 264.
Lichomolgidæ, 258.
Life-histories and development o the food-fishes, 19, 218.
Liparis montagui. *See* Diminutive Sucker.
Loch Assynt, fauna of, 289.
Loch Awe, fauna of, 289.
Loch Mullach Corrie, fauna of, 287.
Loch Tay, fauna of, 284.
Lobsters, hatching of, 11.
—— —— in Canada, 393.
Lumpenus lampetræformis, 19, 225.
Lumpsucker, rate of growth of, 333.
Lyonsia, 265.
—— *norvegica*, 265.
Lysianassidæ, 262.

Mackerel curing, 388.
—— fishery in the United States, 393, 395.
—— fishing in Ireland, 388.
—— —— at Kinsale, 390.
—— inquiry respecting, 17.
—— Scottish, fishing for, 16.
Marine Biological Association, 385.
Masterman, Mr Arthur T., B.A., 20, 272.
M'Intosh, Professor, 15, 218, 272, 297.
Mesh of trawl-nets, relation of size to,
—— cod, 310.
—— dab, common, 308.
—— dab, long rough, 308.
—— gurnard, 312.
—— haddock, 310.
—— lemon soles, 307.
—— plaice, 306.
—— whiting, 311.
Methods of fishing for herrings in Clyde, 18.
Metopa, 263.
—— *propinqua*, 263.

Mill, Dr H. R., 336.
Misophria, 237.
—— *pallida*, 237.
Misophriidæ, 237.
Modiolicola insignes, 259.
Moray Firth, closure of, to beam trawling, 14.
—— trawling experiments in, 27.
Mortimore, Mr Thomas, 21.
Mussel-culture, 387.
Myology of pectoral arch in gurnard, 325.

Nannopus, 253.
—— *palustris*, 253.
Nemertidæ, 265.
Nereis, swarms of sexual form, 187.
New South Wales, fisheries of, 393.
Normanella, 250.
—— *dubia*, 250.
North Sea, currents in, 351.
Norway, fisheries of, 398.
Norwegian topknot, 19, 227.

Orchomene, 262.
—— *batei*, 262.
Oyster-culture, 387.

Pandoridæ, 265.
Paracalanus, 235.
—— *parvus*, 235.
Paramphithoë, 264.
—— *assimilis*, 264.
—— *monocuspis*, 264.
Paramphithoidæ, 264.
Parliamentary committee, inquiry by, 9.
Pathology of fishes, notes on, 291.
Paton, Dr Noel, 297.
Pelagic fauna, 20.
Pelagic ova, list of, 298.
Petersen, Dr, 302, 400.
Pettersson, Professor, 336.
Phryganeidæ, 288.
Physical investigations on board H.M.S. 'Jackal,' 21, 337.
Physiology of fishes, notes on, 291.
Pilchard, development of, 386.
Pisidium pusillum, 285.
Plaice, hatching of, 10.
—— larvæ of, 168, 215.
Pleuroxus trigonellus, 286.
Pogge, rate of growth of, 334.
Polyphemus pediculus, 286.
Pontopolites, 251.
—— *typicus*, 251.
Pseudanthessius, 258.
—— *gracilis*, 260.
—— *liber*, 258.
—— *sauvagei*, 260.
—— *thorelli*, 259.
Pseudocyclopia, 236.
—— *caudata*, 236.
Pseudocyclopiidæ, 235.
Pseudocyclops, 237.
—— *crassiremis*, 237.
Pseudowestwoodia, 256.
—— *andrewi*, 257.
Pterinopsyllus, 238.
— *insignis*, 238.

Rate of growth of fishes, 20, 333.
Relation of the size of mesh to the size of fish captured, 306.
Relative quantities of fish taken by line and beam trawl, 28.
Rhombus maximus. *See* Turbot.
Rhombus (*Zeugopterus*) *norvegicus*, 227.
Russia, fisheries of, 404.

Sabelliphilus sarsi, 258.
Sail Fluke (*Arnoglossus megastoma*), egg resembling that of, 224.
Saithe, development of, 19.
Salmon, food of, 292.
—— seasonal changes in viscera of, 291.
Sand-eel, eggs of, 313.
—— larvæ of, 315.
—— ovi-position and growth of, 313.
Sandeman, Mr George, M.A., F.Z.S., 21, 291.
Scott, Mr Andrew, 231.
Scott, Thomas, F.L.S., 17, 20, 187, 231, 284.
Scottish mackerel fishing, 16.
Sea Fisheries, Parliamentary Committee on, 384.
Sea-scorpion, rate of growth of, 333.
Seasonal changes in fishes, 291.
Seine-net fishing for herrings at Ballantrae, 18.
Sida crystallina, 286.
Soles, hatching of, 11.
—— pathological conditions of, 294.
Spain, fisheries of, 403.
Spawn-collector, floating, 207.
St Andrews Bay, trawling experiments in, 13.
Statistics of line and trawl caught fish, 28, 179.
—— showing the quantities of line caught fish from territorial waters, 30.
Stenhelia, 239.
—— *denticulata*, 240.
—— *dispar*, 239.
—— *hirsuta*, 239.
—— *hispida*, 239.
Stenothoidæ, 263.
Sweden, fisheries of, 395.

Temperature observations, 338.
Territorial waters, deliverance of Parliamentary Committee respecting, 11.
—— deliverance of Institute of International Law respecting, 12.
—— inadequacy of present limit of, 11, 12, 385.
—— quantity of fish caught in, 30.
Tetragoniceps, 244.
—— *consimilis*, 244.
Thalestris, 255.
—— *forficuloides*, 255.
Tosh, Mr James R., M.A., B.Sc., 19, 20, 300, 333.
Trawling experiments, report on, 13, 22.
—— Firth of Clyde, 28.
—— —— Forth, 24.
—— Moray Firth, 27.
—— result of, 32.
—— St Andrews Bay, 25.

Trawling, remarks on, by Professor M'Intosh, 165.
—— vessels, changes in, 169.
—— and the fisheries, observations on, 15.
Trawl-nets, relation between size of mesh and fish captured, 302.
Trigla gurnardus. *See* Gurnard.
Trout, catarrh of gills of, 294.
Tunny, on the skeleton of the, 272.
Turbot, hatching of, 11.
—— eggs and larvæ of, 19, 222.
United States, work of Fish Commission, 393.
—— money spent on fisheries, 393.

Valvata piscinalis, 285.
Varigny, M. de, 297.
Vela, Lieut. R. G., 403.

Williamson, Mr H. C., M.A., B.Sc., 19, 298, 322.
Woodall, Mr John, 205.

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